



# INNOVATIVE ASIA

## ADVANCING THE KNOWLEDGE-BASED ECONOMY

# INNOVATIVE ASIA ADVANCING THE KNOWLEDGE-BASED ECONOMY

HIGHLIGHTS OF THE FORTHCOMING ADB STUDY REPORT

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# 47th ADB Annual Meeting

## Knowledge Sharing and Partnership

### Events: The Silk Road – Connecting Asia with the Changing World

This paper provides highlights from an Asian Development Bank (ADB) study titled “Asia’s Knowledge Economies: Next Policy Agenda.” A suite of reports will be completed shortly under this study: a flagship report on knowledge-based economies in Asia; four country reports on the People’s Republic of China, India, Indonesia, and Kazakhstan; and a report on creative productivity in Asia in partnership with the Economist Intelligence Unit.

The study has assessed the current state of knowledge-based economies in a number of developing Asian economies and has benchmarked them with advanced economies using the four pillars of innovation, information and communication technology, education and skill, and the economic and institutional regime. The underlying premise is that emerging economies in Asia can climb up the ladder of higher value-added products and services in global markets and go beyond middle-income levels by strengthening knowledge-based development processes. The study outlines policy actions required in developing member countries of ADB to advance as knowledge-based economies. It identifies how emerging economies can draw on game-changing technology trends and other developments to move faster toward the global knowledge frontier.

This paper was prepared by Shanti Jagannathan, Senior Education Specialist, Regional and Sustainable Development Department, ADB ([sjagannathan@adb.org](mailto:sjagannathan@adb.org)). Members of the ADB team who worked on this study include Donghyun Park, Principal Economist, Economics and Research Department, ADB ([dpark@adb.org](mailto:dpark@adb.org)) and Seok Yong Yoon, Senior Public Management Specialist, Regional and Sustainable Development Department, ADB ([syoon@adb.org](mailto:syoon@adb.org)). Carl Dahlman, Jae Moon, Ron Perkinson, and Poh Kam Wong are the four international consultants who contributed to this policy research project. The national experts who contributed to the country studies in the People’s Republic of China, India, Indonesia, and Kazakhstan are Yang Yao, Arpita Mukherjee, Hafid Abbas, and Oraz Jandosov, respectively. Carmela Fernando Villamar provided coordination and research support throughout the study. Ross O’Brien provided editorial and infographic support.

The project was implemented under the overall guidance of Bindu N. Lohani, Vice-President for Knowledge Management and Sustainable Development, ADB; Woochong Um, Deputy Director General, Regional and Sustainable Development Department, ADB; and Bart Edes, Director, Poverty Reduction, Social Development, and Governance Division, Regional and Sustainable Development Department, ADB. To provide strategic guidance to the study, ADB had established a high-level panel, which is cochaired by Lawrence Summers, Charles W. Eliot University Professor, Kennedy School of Government, Harvard University and Kishore Mahbubani, Dean and Professor in the Practice of Public Policy, Lee Kuan Yew School of Public Policy, National University of Singapore. The other members of the panel are Bindu N. Lohani, Vice-President for Knowledge Management and Sustainable Development, ADB; Han Duck-soo, Chairman and Chief Executive Officer, Korea International Trade Association; Takatoshi Ito, Dean, Graduate School of Public Policy, University of Tokyo; K. Vaman Kamath, non-executive Chairman of the Board of Directors, ICICI Bank, and Infosys Technologies; Justin Yifu Lin, Honorary Dean, National School of Development, Peking University; Mari Pangestu, Minister of Tourism and Creative Economy, Indonesia; Andrew Sheng, President, Fung Global Institute; and Dominic Barton, Global Managing Director, McKinsey & Company.

# Introduction

# 1

The development of knowledge-based economies (KBEs) is both an imperative and an opportunity for developing Asia. It is an imperative to sustain high rates of growth in the future and an opportunity whereby emerging economies can draw from beneficial trending developments that may allow them to move faster to advance in global value chains and in position in world markets.

Over the last quarter of a century, driven mostly by cheap labor, developing countries in Asia have seen unprecedented growth rates and contributions to the global economy. Sustaining Asia's growth trajectory, however, requires developing economies to seek different approaches to economic growth and progress, especially if they aspire to move from the middle-income to the high-income level. KBE is an important platform that can enable them to sustain growth and even accelerate it.

Much of the exemplary growth in Asia has come from its economies' long-held comparative advantage in labor-intensive goods. Emerging economies will, however, find it impossible to continue their success under the same growth models used over the last few decades, as technological progress changes the ways countries produce and trade. With rising wages across the region, most Asian economies stand to lose their comparative advantage for labor-intensive manufacturing and additionally will also feel the pressure exerted on increasingly scarce and costly energy resources. Asia's economies also face a looming "middle-income trap" where the economic success a country achieves through comparative labor advantage diminishes as wages rise and productivity levels decline, slowing overall economic growth. For Asia's emerging economies to avoid the middle-income trap that has affected economies like Brazil, the Russian Federation, or Turkey, they need to effectively shift from accumulation-led growth to productivity-led growth, offsetting slowing labor force growth through innovation to sustain productivity. As part of structural transformation, advanced economies shifted from agriculture to industry and to services: Now services account for the bulk of output and employment. This transformation is slow in developing countries, and knowledge will become increasingly important as a source of productivity growth. While many countries in Asia have expanded their industrial base and increased the share of the services sector, they need to avoid being stuck in the middle-income trap—KBE is an important way forward.<sup>1</sup>

It is time for Asia to consolidate and accelerate its pace of growth. Asia is positioned in a unique moment in history with many advantages that can serve as a boost: to name a couple, an expanding middle of the pyramid—Asia is likely to hold 50% of the global middle class and 40% of the global consumer market by 2020; and the growing importance of intra-regional trade within Asia, increasing from 54% in 2001 to 58% in 2011. Many developing economies are well placed to assimilate frontier technologies into their manufacturing environment.

**Over the last quarter of a century, driven mostly by cheap labor, developing countries in Asia have seen unprecedented growth rates and contributions to the global economy**

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<sup>1</sup> ADB. 2013. *Key Indicators for Asia and the Pacific 2013. Special Chapter: Asia's Economic Transformation: Where to, How, and How Fast?* Manila.



## 2

# Learning from Advanced Economies

**Middle-income countries are squeezed between low-wage, low-income competitors that dominate labor-intensive mature industries and the high-income innovators that dominate industries undergoing rapid technological change**

Advanced economies have consistently focused on knowledge-based economic development in order to reach high-income status. A number of countries in Asia are at or approaching middle-income levels. Further growth of middle-income countries must increasingly rely on high skill-intensive industries and a deeper stock of physical and human capital. Middle-income countries are squeezed between low-wage, low-income competitors that dominate labor-intensive mature industries and the high-income innovators that dominate industries undergoing rapid technological change. In other words, middle-income countries must successfully climb the development ladder and catch up with advanced countries in the transition to the high-income level.

A working paper of the Asian Development Bank Institute highlights two areas as being important in making the transition from the middle-income to the high-income level.<sup>2</sup> One is the timely focus of policy and public sector investment in infrastructure and human capital so as to develop new technology- and knowledge-intensive industries. The other is high-quality institutions that generate and maintain a dynamic private sector that is innovative and sensitive to changes in international markets.

The United States has been a world leader in leveraging innovation to achieve broader economic aims. It has consistently invested heavily in research and development (R&D), higher education, and information and communication technology (ICT). Japan's knowledge-based economic growth journey is a story of rapid catch-up with the advanced countries through a process of importing advanced capital goods, licensing foreign technology, and encouraging international tertiary education. Strong investment in commercially oriented R&D together with a strong focus on exports of manufactured products tilted the economy's strengths toward high value-added sectors such as electronic hardware and components.

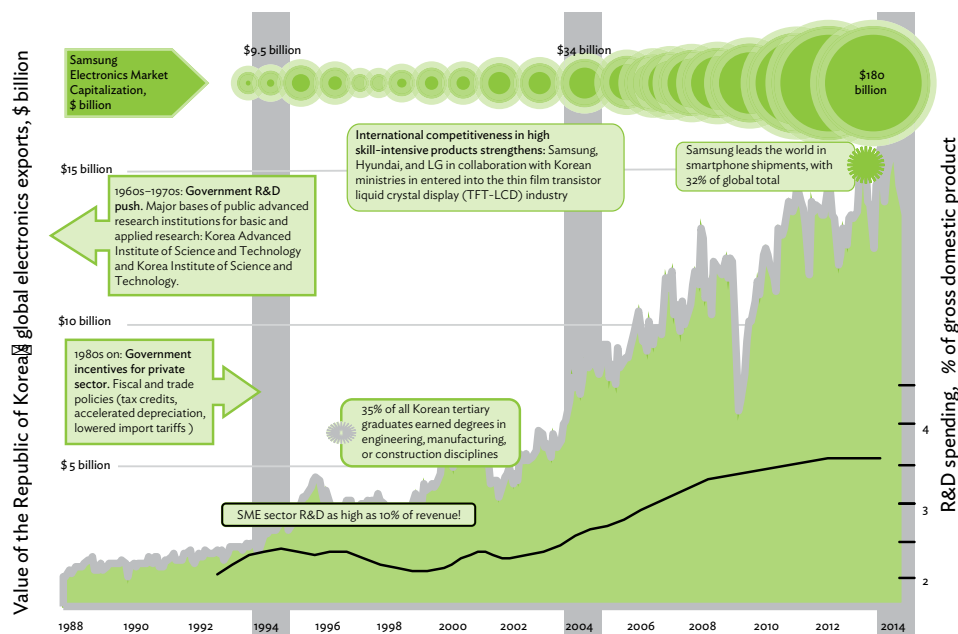
In this section, we highlight the journey of the Republic of Korea and Singapore: the two countries achieved remarkable transformation of their economies to high-income levels through systematic knowledge-based economic development.

The Republic of Korea made a remarkable transition to a knowledge economy in about 15 years. It started with a rapid industrialization process based on labor-intensive exports, import of capital goods from advanced countries, and technology licensing. Building on import of capital goods and licensed technology, the country's policy makers went on to supporting state champions in the private sector. During the 1960s and 1970s, the country set up major bases of public advanced research institutions for basic and applied research, such as the Korea Advanced Institute of Science and Technology and the Korea Institute of Science and Technology. R&D as a percentage of gross domestic product (GDP) has been steadily on the rise and increased from 0.5% in 1965 to 2.5% in 1997 and 3.7% in 2010. The country intends to increase this to 5% of GDP. There was explicit

<sup>2</sup> VT. Tran. 2013. The Middle-Income Trap: Issues for Members of the Association of Southeast Asian Nations. ADBI Working Paper Series No. 421. Tokyo: Asian Development Bank Institute. Available at <http://www.adbi.org/working-paper/2013/05/16/5667.middle.income.trap.issues.asean/>

investment in the ICT industry, which puts the economy in a leading position in terms of telecom infrastructure and usage. Coordination across 17 ministries for R&D and the ICT sector solidified its position in the information technology (IT) sector. Strong education reforms and links between tertiary and employer-based training built the human capital base needed for the country to advance as a knowledge economy. While initially the government invested significantly, from the 1980s onward, the private sector started playing a more important role. Government incentives were provided through fiscal and trade policies (tax credits, allowing accelerated depreciation, lowering of import tariffs). Even smaller companies invested in R&D—in some cases, R&D of small and medium-sized enterprises (SMEs) was as much as 10% of total sales. From the mid-1990s onward, the country's international competitiveness in high skill-intensive products had strengthened. Corporations such as Samsung, Hyundai, and LG, in collaboration with Korean ministries in charge of promoting technological innovation, entered into the thin film transistor liquid crystal display (TFT-LCD) industry providing a challenge to the Japanese companies that were leading the market. By 1999, the share of tertiary graduates in engineering, manufacturing, and construction was 35%. Currently the country's higher education enrollments are among the highest in the world.

Figure 1 Republic of Korea KBE Timeline



KBE = knowledge-based economy, R&D = research and development, SMEs = small and medium-sized enterprises.

Sources: Samsung Electronics Annual Reports, Bloomberg, Republic of Korea National Statistics Office, Haver Analytics, Economist Intelligence Unit.

The Republic of Korea continues its KBE journey through a super ministry combining science and technology and IT: Ministry of Science, ICT and Future Planning.

Singapore moved from being an entrepôt to a KBE. The journey of its development process is as follows: 1960–1969 labor-intensive growth, 1970–1979 skill-intensive growth, 1980–1989 capital-intensive growth, 1990–1999 technology-intensive growth, and 2000 onward knowledge and innovation economy-based growth. The initial years witnessed economic growth driven by foreign direct investment (FDI), and in the 1990s, there was an orchestrated move to focus on technology to transform into a KBE. The country initially promoted FDI to access high technology and participation in global trade and then moved to domestic R&D capabilities. Like the Republic of Korea, its R&D expenditure was 0.5% of GDP in the initial years and has steadily grown to 2.3% of GDP. The country intends to increase it to 3.5% of GDP. The Economic Development Board coordinated investment in R&D and technical education and promotion of high-tech industries for Singapore's future strength.



There was active promotion of ICT both in hardware and use in government, industry, and society. The economy invested heavily in upgrading technical education and subsidized multinational corporation (MNC) training to raise the skill levels of its workforce. Partnerships with world-leading educational institutions enhanced the availability of talent pools for a KBE. There was deliberate investment in building Singapore's strengths as a trading economy. Competitiveness in trading services was built up and ICT investments related to trade and logistics have made the country emerge at the top in the World Bank's Logistics Performance Index rankings in 2012.

Manufacturing moved up the value chain with new capabilities in semiconductors and aerospace engineering. During 1991–1995, the National Technology Plan to boost R&D activities and investments was put in place. During the 2000s, manufacturing clusters further diversified to include biomedical sciences. Output and value added for manufacturing tripled in the last 2 decades.

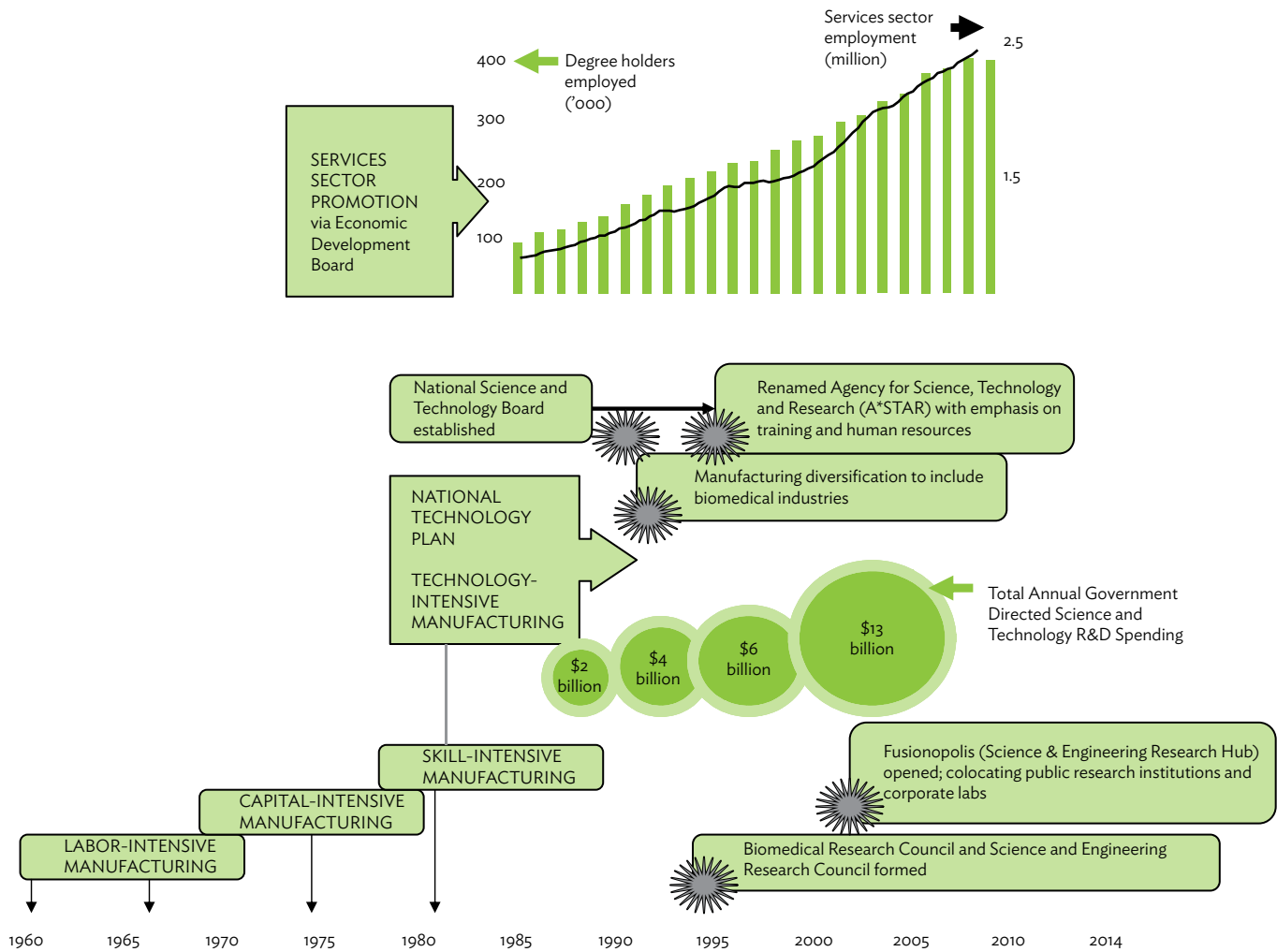
The 1990s also saw the growth of the services sector with the setting up of the Services Promotion Division in the Economic Development Board. The country diversified into the services sector, and in 1997, the competitiveness committee included services with manufacturing as twin engines of growth for the economy. Singapore soon emerged as a hub of services and further developed new high-growth services capabilities. Today, Singapore is a leading business and financial hub in Asia and is ranked among top global financial centers.

**In 1991, the National Science and Technology Board was set up to raise Singapore's capabilities in science and technology**

Singapore gradually and steadily fostered an education environment that facilitated R&D and created local talent. In 1991, the National Science and Technology Board was set up to raise Singapore's capabilities in science and technology. The number of research scientists and engineers grew from 28.2 per 10,000 workers in 1990 to 87.9 per 10,000 workers in 2000. In 2000, the Biomedical Research Council and the Science and Engineering Research Council were formed. In 2002, the National Science and Technology Board was renamed Agency for Science, Technology and Research (A\*STAR) to increase emphasis on training research personnel to transition to a KBE. The \$500 million Biopolis was created in 2003 to provide world-class biomedical R&D facilities with shared research for the public and private sectors and Fusionopolis, the science and engineering research hub, was added in 2008. The colocating of public sector research institutions and corporate labs has served the economy very well.

The key areas for emerging economies to address, learning from the experience of advanced economies, are systematic and continued investment and policies to build R&D capability; investments in creating a deeper stock of human capital; improving education systems that provide the capabilities needed to enhance competitiveness of key knowledge-intensive sectors; putting in place appropriate economic, institutional, and incentive structures that help to tap investments from a dynamic private sector; catalytic role played by the government, particularly in the early stages of KBE processes to create the climate required to attract the private sector; the critical expansion of the quality and relevance of higher education, applied research, and industry–university collaborations; and investments in telecom and ICT infrastructure that permeate the economy and bring many spin-offs, such as better delivery of government services, improved governance, trade in services, and links with global supply chains.

Figure 2 Singapore KBE Timeline



KBE = knowledge-based economy, R&D = research and development.

Sources: Singapore Economic Development Board, Ministry of Manpower, Haver Analytics, Economist Intelligence Unit.

## 3

# State of Play of Knowledge-Based Economies in Asia and the Pacific

In order to measure and monitor progress of economies as KBEs, the World Bank developed the Knowledge Economy Index (KEI), using a four-pillar framework:

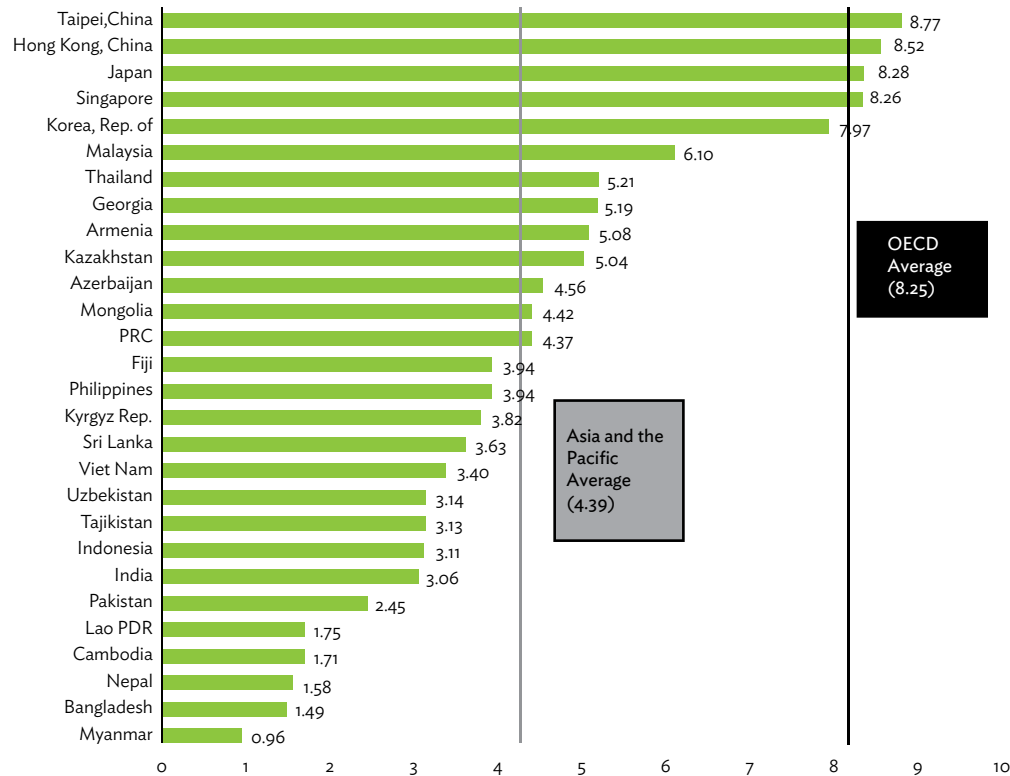
Table 1 Four Pillars of the Knowledge Economy Index

Pillar	Description	Indicator
Economic and institutional regime	An economic and institutional regime to provide incentives for the efficient use of new and existing knowledge and the flourishing of entrepreneurship	<ul style="list-style-type: none"> <li>• Tariff and non-tariff barriers</li> <li>• Regulatory quality</li> <li>• Rule of law</li> </ul>
Education and skill of population	An efficient innovation system of firms, research centers, universities, consultants, and other organizations to tap into the growing stock of global knowledge, assimilate and adapt it to local needs, and create new technology	<ul style="list-style-type: none"> <li>• Adult literacy rate</li> <li>• Gross secondary enrollment rate</li> <li>• Gross tertiary enrollment rate</li> </ul>
Information infrastructure	An educated and skilled population to create, share, and use knowledge well	<ul style="list-style-type: none"> <li>• Telephones per 1,000 people</li> <li>• Computers per 1,000 people</li> <li>• Internet users per 1,000 people</li> </ul>
Innovation system	Information and communication technology to facilitate the effective creation, dissemination, and processing of information	<ul style="list-style-type: none"> <li>• Royalty payments and receipts (\$ per person)</li> <li>• Technical journal articles per 1 million people</li> <li>• Patents granted to nationals by the United States Patent and Trademark Office per 1 million people</li> </ul>

Source: World Bank, Knowledge Assessment Methodology and Knowledge Economy Index.

A comparison of various countries on the KEI reveals that emerging economies in Asia and the Pacific perform far lower on the overall KEI as compared to countries of the Organisation for Economic Co-operation and Development (OECD). In the section below, an assessment of the position of emerging economies of Asia and the Pacific is provided.

Figure 3 Knowledge Economy Index Scores



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

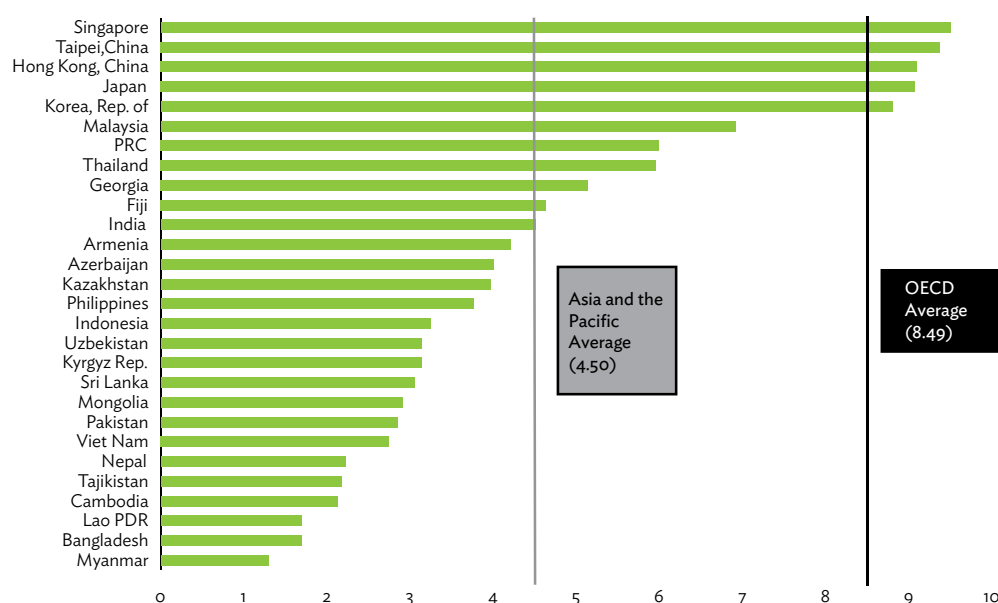
## Innovation Pillar

Emerging economies in Asia perform way below advanced economies in relation to all indicators of R&D activities—total expenditure and business expenditure on R&D as a percentage of GDP, as well as total and R&D personnel in business. The People's Republic of China (PRC), which is a leader among emerging economies, is still significantly behind advanced nations. Other than the PRC, none of the emerging economies have R&D investments in the amount of 1.5% of GDP that countries such as Japan, the Republic of Korea, and Singapore undertook at middle-income levels. There is need to increase investment in R&D and address the efficient and effective use of R&D and its speedy commercialization.

Emerging economies need to balance attracting and exploiting global knowledge (such as the technological catch-up achieved by Japan, the Republic of Korea, Singapore, and Taipei, China) and encourage the production of new indigenous innovation. Less developed economies in Asia need to prioritize the effective absorption of global knowledge, while middle-income economies need to move into technology creation capabilities to overcome the “middle-income trap.”

Japan and the Republic of Korea have relied on rapid “domestication” of innovation: expanding the R&D capabilities of their indigenous firms, particularly their diversified conglomerates. Singapore,

Figure 4 Innovation Sub-index Scores, Knowledge Economy Index



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

**Grassroots innovation and frugal innovation have gained ground in Asia: India's National Innovation Foundation and the Tianjin University have documented indigenous innovations**

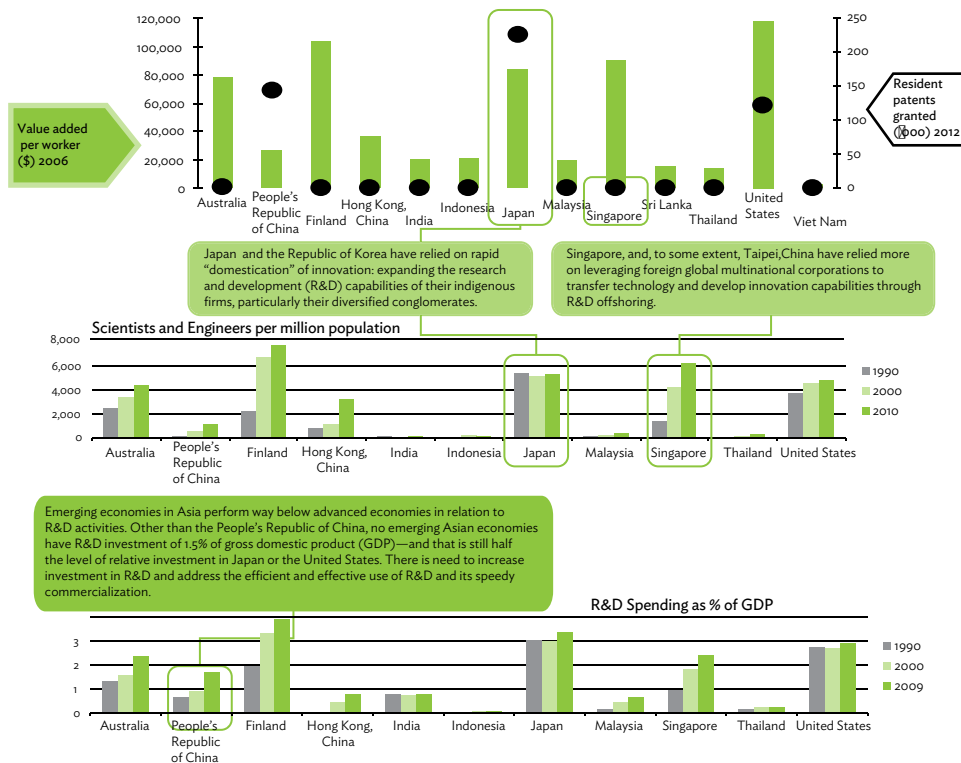
and, to some extent, Taipei, China have relied more on leveraging foreign global MNCs to transfer technology and develop innovation capabilities through R&D offshoring. The case of the Industrial Technology Research Institute (ITRI) of Taipei, China working with a consortium of SMEs to achieve scale economy in R&D activities, where participating firms were provided preferential access to the intellectual property arising from the R&D at very low licensing fees, led to the economy's dominance in the laptop computer manufacturing market. Emerging economies need to consider "pooling" of R&D investments and innovation for industry-wide competitiveness, and this would include the main industry segment as well as supply chain industries and services industries, including possibly logistics and transport.

Grassroots innovation and frugal innovation have gained ground in Asia: India's National Innovation Foundation and the Tianjin University have documented indigenous innovations. Public policies can build on these successes by channeling more public funding of R&D for low-income-relevant technologies. Public policies to promote and support social entrepreneurship will also help, such as the promotion of social impact investing.

Innovation in services industries has promise for Asia: many traditionally non-tradable knowledge-based services sectors in the advanced economies—medical diagnostics, architectural designs, and business accounting and analytics—are increasingly offshored to lower-cost developing economies, and Asia's well-established IT-enabled services and business process outsourcing clusters are becoming the primary beneficiaries of these global flows. To build upon this offshoring opportunity, however, developing Asia needs to continue to invest in its innovation capacity in order to remain competitive.

For emerging economies, there is a need for public sector funding to ease bottlenecks that prevent new technologies from being commercialized by local start-ups. This would include proof-of-concept and patent application grants, innovation voucher schemes, and incentives for collaboration between firms and universities. The Small Business Innovation Research program in the United States and the Tekes program in Finland can be adapted to developing economy contexts. Private financial service firms can also be incentivized to provide funding for innovation-based start-ups. Examples include business angel investment co-matching schemes and incubator development programs that

Figure 5 Innovation Pillar: Various Dimensions



Sources: National statistics bureaus, Economist Intelligence Unit.

attract and leverage foreign scientists and investors (e.g., Israel's Incubation Support program and Singapore's Business Angel Scheme and Incubator Development Program). Public investment in such intermediary instruments to promote commercialization of new technology is required ahead of market demand.

## Education and Skill Pillar

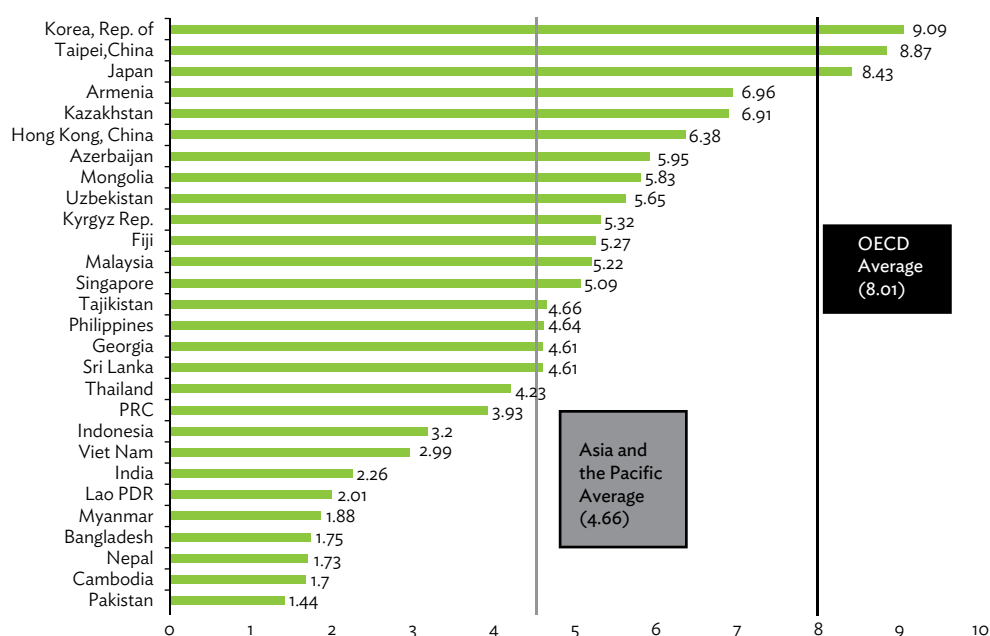
Education systems worldwide are undergoing major upheavals and transformations that also affect economies in Asia. A new paradigm for this sector is called for more than any other pillar.

Evidence from OECD countries suggests that a growing proportion of employees with tertiary level qualifications are employed in knowledge-intensive industries.

Knowledge and skills are necessary but not sufficient. Firms in KBEs increasingly require "competence" rather than just certified qualifications—a mix of "hard" and "soft" skills. New formal vocational and academic education and training need to give rise to a wide variety of highly skilled technical and professional talent. A key attribute required of education systems is to develop more flexible and responsive programs to provide the necessary qualifications and competencies required in the marketplace. Countries that have done well to strengthen the status attached to higher vocational studies, such as Singapore and the Republic of Korea, offer good lessons for developing economies. The Republic of Korea's tailor-made education led to successful employment and the creation of human capital that enterprises needed. There is need for a variety of higher-order vocational and polytechnic degrees and applied degrees in addition to academic qualifications.



Figure 6 Education and Skill Sub-index Scores, Knowledge Economy Index



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

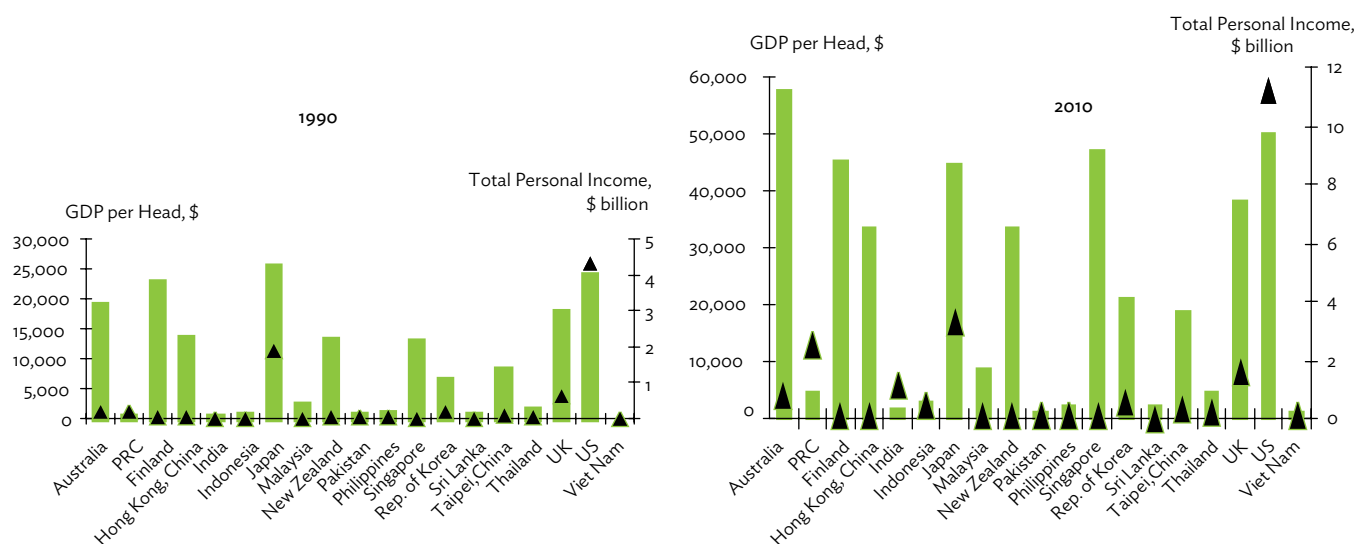
Technology parks can no longer be stand-alone but need to have supportive ecosystems with colocation of high-quality technical universities, links with large companies that can be potential customers of technologies, R&D collaborators, venture investors, technology transfer intermediaries, and knowledge-based service providers such as branding and advertising.

The development of “world class” universities that have strong links with leading universities globally is particularly important for Asia. By attracting global talent and collaborating with leading research universities, the National University of Singapore has emerged as a global research hub in graphene and membrane technology. Likewise, the PRC’s recent rapid rise as a leader in the field of nano-technology has been facilitated by researchers in the PRC, many of whom are returnees, who bridge scientific worlds by publishing scientific papers with both domestic and international colleagues. It is important, however, that this does not come at the cost of ensuring a diverse education system of acceptable quality catering to populations in developing economies.

In advancing toward KBEs, linking ICT with education is likely to be one of the most powerful tools for bringing about improvements in quality, relevance, equity, and transformational pedagogy. The “digital natives” of today’s world learn in completely new ways that blend different modalities and institutional settings. The game-based and simulation-based learning markets in the United States are growing at a fast rate. The onset of massive open on-line courses (MOOCs) has challenged the brick-and-mortar-only type of educational institution. Anytime-anywhere learning and blended learning approaches will become the order of the day. The sooner emerging economies explore and implement promising ICT solutions in and for education, the higher the opportunities for game-changing improvements to education systems and the quality of delivery of educational services.

The role of tertiary institutions as commercial incubators of technology and innovation is fast gaining ground. While good examples are available in advanced Asian economies such as the Republic of Korea, recent trends need to be tracked. As an example, the University of Southern California Viterbi School of Engineering, in partnership with the venture capital firm Kleiner Perkins

Figure 7 Education and Skill Pillar: Various Dimensions

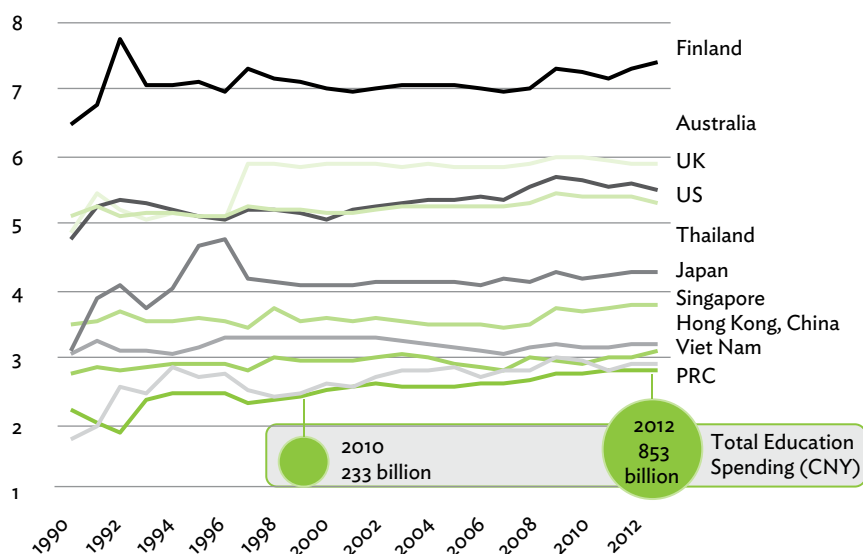


GDP = gross domestic product, PRC = People's Republic of China, UK = United Kingdom, US = United States.

Sources: National statistics bureaus, Economist Intelligence Unit.

Human capital of higher order is required in enterprises for effective and efficient use of research and development (R&D). While the overall quantum of R&D personnel in companies is low in developing economies, so is their capacity. There is need to build capabilities for R&D but also for venture capital investing experience and mentoring of early start-ups. The success of high-tech start-ups will depend upon such human capital support in addition to finance. This requires training systems to look at on-the-job skill updating and upskilling in partnership with employers. The teaching of innovation and entrepreneurship is important for emerging economies to develop the human potential required for knowledge economies. Building problem solving and critical thinking into curriculum development in tertiary institutions across Asia is crucial. Asia's entrepreneurs are found to be emerging from "necessity" (not finding employment, therefore turning to entrepreneurship) rather than leading change.

Total Spending on Education  
% of GDP



GDP = gross domestic product, PRC = People's Republic of China, UK = United Kingdom, US = United States.

Sources: National statistics bureaus, author estimates based on Economist Intelligence Unit.

Education, training, and lifelong learning are critical to economies advancing as knowledge-based economies (KBEs). **New and reengineered systems of education and training will provide the fuel for emerging economies' KBE initiatives.** Education systems worldwide are undergoing major upheavals and transformations that also affect economies in Asia. A new paradigm for this sector is called for more than any other pillar.

Advanced economies too are seeking to produce graduates who can become knowledge workers and support innovation in their economies. Developing Asian economies are still struggling to expand their tertiary education systems, although some countries, notably the People's Republic of China (PRC), have invested significantly to expand their systems. While enrollments have increased tremendously, so has graduate unemployment. In 2008, more than 25% of the PRC graduates did not find a job. Quality and relevance of education is of paramount importance in serving the needs of a knowledge economy. There is an urgent need to increase emphasis on science, technology, engineering, and mathematics in secondary and post-secondary education.

Caufield & Byers and the talent and literary agency United Talent Agency announced the Viterbi Startup Garage, an early-stage technology accelerator designed to provide financial and strategic support to student and alumni entrepreneurs. The United States National Science Foundation supports the University Innovation Fellows program implemented as a joint venture between the National Collegiate Inventors and Innovators Alliance and Stanford University to provide training to undergraduate and graduate students to conduct research and use resources to bring innovation and venture activity to their campuses. These types of partnerships need to permeate Asia's tertiary education institutions.

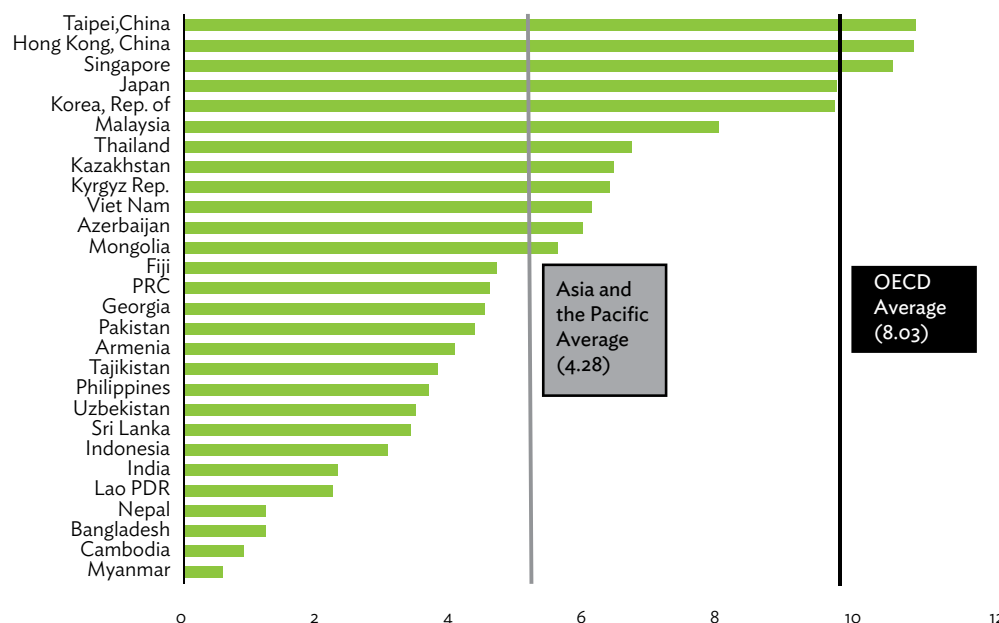
## Information and Communication Technology Pillar

Advanced countries such as the Republic of Korea invested strongly in creating a nationwide ICT infrastructure ahead of the actual demand picking up. This contributed to the country's ability to put the infrastructure to good use through a large number of e-government and business applications. Emerging economies have much to learn from this experience in creating ICT readiness. For developing economies, widespread ICT infrastructure and network connectivity that straddles the urban and rural divide can be a powerful force for inclusive development.

Emerging economies in Asia are in a unique position to leverage ICT for accelerating economic growth with social impact. Asian economies have taken leading roles in the production and use of ICT goods and services. In 2011, ICT accounted for nearly a quarter of developing Asia's exports, twice the global average. In the last decade, developing Asian economies have become important players in the global ICT sector, and some Asian economies have considerably better ICT capacity (according to the Network Readiness Index), than their per capita income would suggest.

In Asia alone, there are nearly 9 mobile phones for every 10 people, and the majority of these devices also serve as Asia's primary connection to the internet. At 3.5 billion mobile subscriptions, consumers in Asia and the Pacific now account for more than half of the world's total mobile service market.

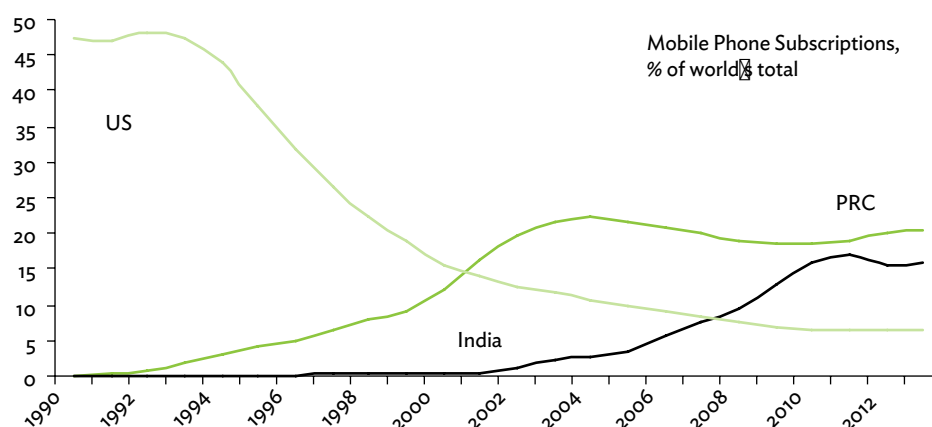
Figure 8 ICT Sub-index Scores, Knowledge Economy Index



ICT = information and communication technology, Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

Figure 9 ICT Pillar: Potential Power of Mobile Phones

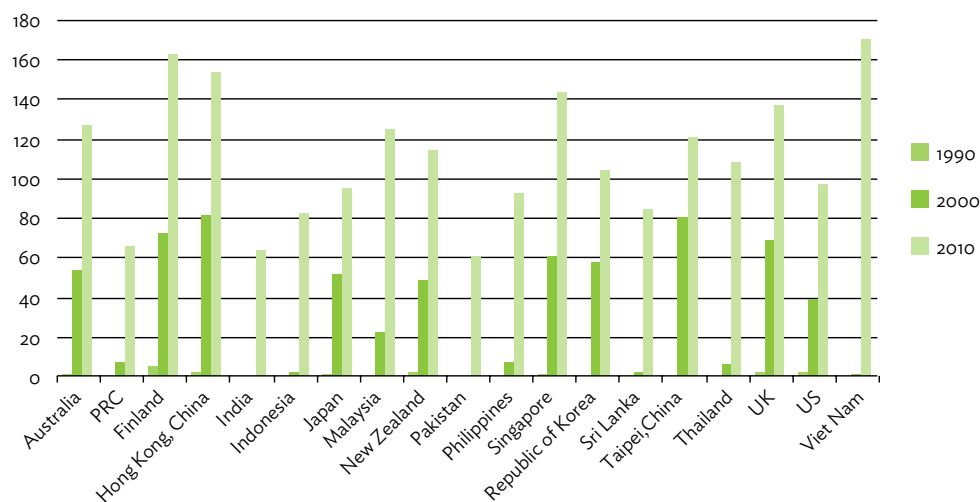


ICT = information and communication technology, PRC = People's Republic of China, US = United States.

Sources: Pyramid Research, Economist Intelligence Unit.

Mobile Phone Subscriptions per 100 Population

Ensuring market competition is an important tool to promote universal information and communication technology (ICT) coverage at affordable costs. It is important to note that Asian economies are leading the growth of mobile technologies. Therefore, ICT solutions need to consider the ubiquitous presence of mobile phones. There are huge opportunities for development applications for the mobile phone that can serve poorer segments of the population—for this, affordable smartphones need to be made available with content that can be navigated by people with little or no education.

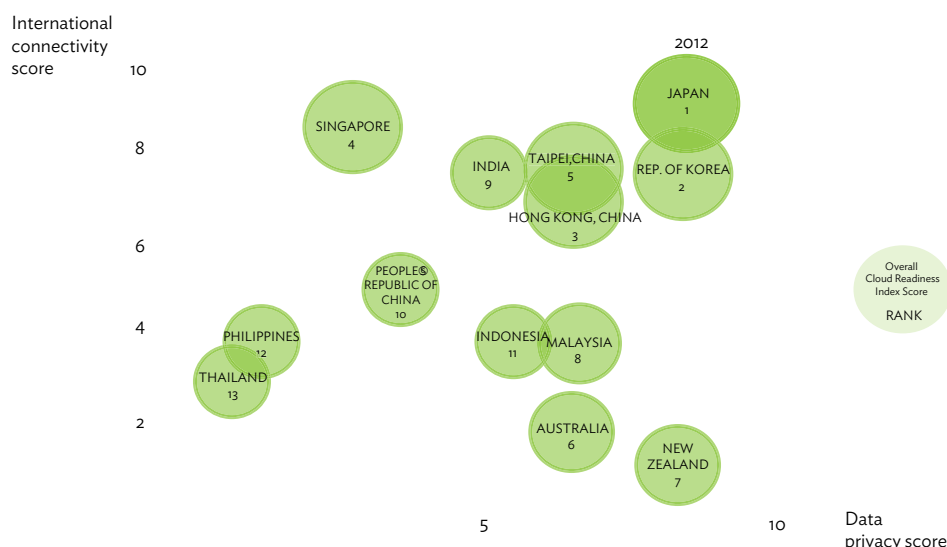


PRC = People's Republic of China, UK = United Kingdom, US = United States.

Sources: Pyramid Research, Economist Intelligence Unit.

Emerging economies need to consider putting in place a comprehensive national broadband policy and plan as studies show the positive correlation between broadband penetration and economic growth. The availability of high-speed broadband in rural areas will serve as an important inclusive development strategy. The application of universal service funds, which have large unspent stockpiles in Asia, to improve connectivity to areas where economic incentives are insufficient will help bridge the digital divide. Extending universal service funds to include high-speed broadband connectivity will serve the economic interests of rural populations. Mobile broadband subscription is three times fixed broadband in developing economies. However, there is still a considerable digital divide in developing economies in terms of broadband connectivity.

Figure 10 Cloud Readiness Index, 2012



Source: Asia Cloud Computing Association, 2012.

Just two markets, the PRC and India, account for nearly 2 billion mobile users. Moreover, Asia, among all emerging economic regions, leaped up the mobile service value chain and seized upon next-generation mobile broadband network infrastructure. While overall mobile penetration levels in developing Asia mirror those in other emerging markets, the adoption of broadband mobile services (3G and 4G) has been much faster.

The workplace in the contemporary economy is increasingly digital. Given that Asia had 7 of the top 10 locations for outsourcing of global services for delivering IT, business process outsourcing, and voice services in 2011, IT-enabled services can be an important source of further comparative advantage. E-commerce, digital enterprises, and creative and entertainment industries—an area where developing Asia has already shown comparative advantage—can receive a great boost with the availability of affordable and high-speed broadband connectivity.

In making ICT penetration universal, developing economies can evaluate the costs and benefits of moving to cloud computing. Trends suggest that by 2016, the bulk of IT spending will be cloud-based. Emerging economies in Asia would do well to anticipate future trends and invest in tomorrow's technologies, even if it entails higher costs, rather than yesterday's technologies. A recent study by the Asia Cloud Computing Association shows that cloud computing will generate 14 million jobs globally in the next 3 years—10 million in Asia alone. As mass markets develop for cloud-enabled services in Asia, prices should fall further, much like mobile services, likewise boosting productivity. This will enable new business development, productivity gains, shared and lower costs, on-demand services, and greater efficiency in markets.

There is an important need to develop the human resource capacity needed for a digital economy. India has recently announced a national digital literacy initiative. On the one hand, a large number of people need to be imparted generic ICT skills; on the other, there is need to invest in higher-order and targeted skills for the ICT sector that will help economies have a competent workforce needed to optimize on applications.

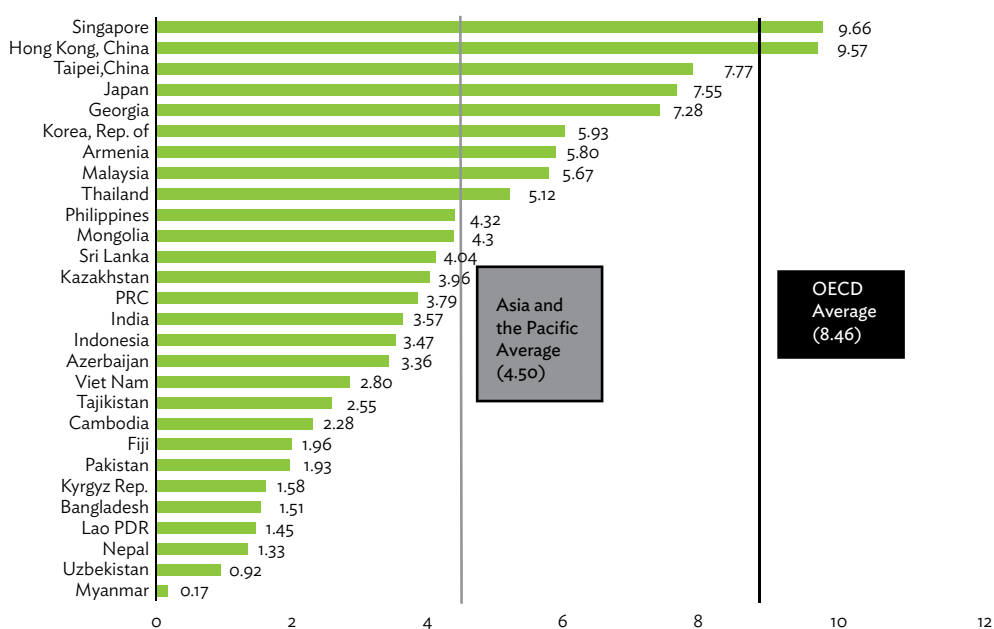
## Economic and Institutional Regime Pillar

A robust economic and institutional regime (EIR) is a critical component of an effective KBE. Most advanced economies are ranked relatively higher on the Ease of Doing Business indicators than developing economies. Economies with large domestic markets are ranked considerably lower. More institutional effort is thus needed to reduce bureaucracy and improve regulatory transparency that impedes business. Kazakhstan's business environment reforms improved its rating significantly between 2011 and 2012.

Advanced high-income economies have strong intellectual property rights (IPR) environments. The PRC, Malaysia, and Sri Lanka have strengthened their IPR regimes in the past decade and rank above the world average. However, it is more than legislation. Despite IPR laws compliant with World Trade Organization (WTO) standards, the PRC is viewed as an IPR threat by foreign companies. With growing digital enterprises and ICT technologies in all walks of life, IPR regimes need to be flexible and adaptable to change.

The government's role as a regulator is critical since it provides stewardship over the economy. Governments that consistently execute focused, well-aligned KBE objectives see their economies progress faster, as can be seen from the experience of advanced countries such as the Republic of Korea and Singapore. Government action is required to mitigate the impact of clear market failures, such as to impose stringent intellectual property protection legislation, promote green growth, or redress social and income inequality. In addition, governments must assume a leadership role in developing a regulatory framework to ensure an effective finance sector, the lifeblood of start-ups and KBE-oriented industry sectors. However, excessive government control and regulation can also be a problem—it can impede the flow of knowledge and technology to a market and it creates bureaucracy, which constrains innovation and entrepreneurship. Singapore is a good example of a country that has achieved fast and efficient coordination across government areas through cross-functional agencies. One such agency is the Economic Development Board, which has been instrumental in attracting FDI and in upgrading Singapore's economic structure. The Korea Institute of Science and

Figure 11 Economic and Institutional Regime Sub-index Scores, Knowledge Economy Index



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.



**Asia's financial underdevelopment can be a major barrier to the development of knowledge-based economies**

Technology Evaluation and Planning supports projects that foster creative knowledge in science and technology that can boost the Republic of Korea's competitiveness. Government leadership is thus crucial to advance a KBE.

In addition to improving the domestic regulatory environment, developing economies also need strong policies to engage with the global economy through trade and FDI policies. The role of MNCs in bringing technology and knowledge into the economies needs to be strengthened through appropriate government policies.

Asia's financial underdevelopment can be a major barrier to the development of KBEs. The underdevelopment of capital markets in Asia's bank-centered financial systems can hamper innovation that requires long-term risk financing. Venture capital markets need further expansion. Lack of financial inclusion is also a barrier to inclusive KBE. Small firms and new entrants need access to financial services in order to carry out innovative activities. Venture capital needs to address the full cycle of innovation: from the pre-concept stage to early venture, intermediate stages, as well as mature and scaling-up stages.

# Highlights of Four Country Studies

## 4

In addition to an overall assessment of Asian economies in the KEI, the study also undertook a review of KBE processes and developments in four countries: the PRC, India, Indonesia, and Kazakhstan. The following section provides a snapshot of the state of play in these countries and issues for consideration in the four pillars of the KEI. (Detailed individual country reports will be available in the third quarter of 2014.)

### People's Republic of China

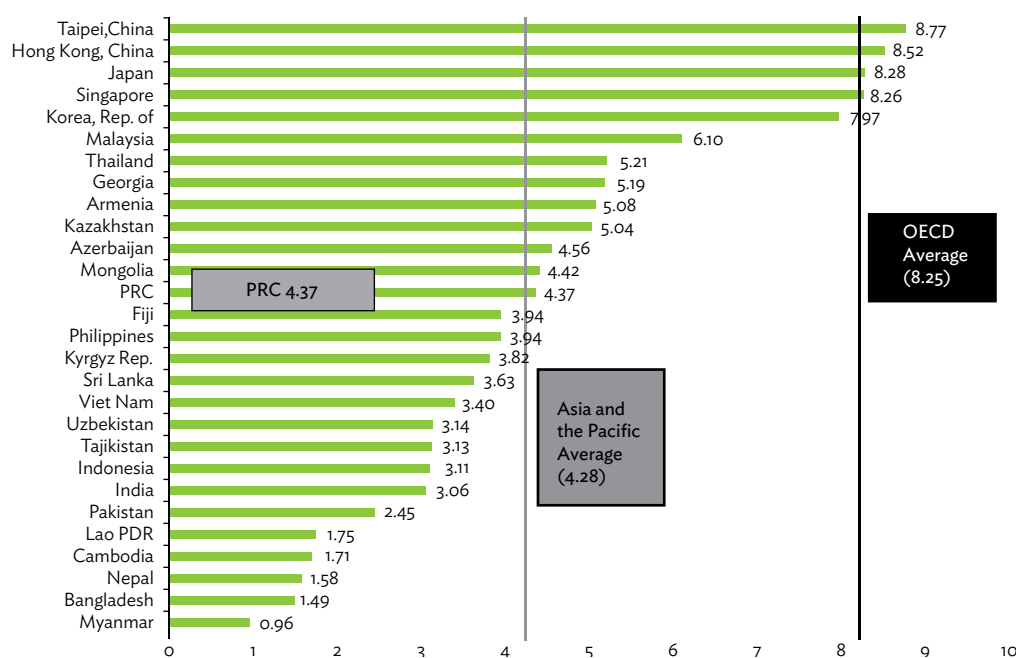
**Economic and Institutional Regime:** A shift to an innovation-driven economy is a key priority for the PRC. It needs to improve its poor ranking in cost of doing business (except enforcing contracts). Furthermore, the thin and government-dominated venture capital fund market needs to have more private participation.

**Innovation:** While the PRC has done very well on many fronts, it also faces challenges. R&D expenditure has increased to 1.6% of GDP in 2012 from 1.1% in 2002, the highest among emerging economies, and it is expected to reach 2.0% by 2020. The PRC is also leading in terms of patent applications. Commercialization of patents leaves much to be desired and there are considerable weaknesses in the enforcement of laws to protect intellectual property. The IPR regime is considered poor by foreign investors. The PRC has done very well on inputs to innovation: R&D personnel and R&D expenditures. However, there is need to link R&D to commercialization and to long-term plans for competitiveness, as well as to promote greater private R&D, as advanced economies have done at the middle-income level. The PRC's innovation score is higher than the average in Asia and the Pacific and gives it a higher than average KEI score.

**Education:** Tertiary enrollments in PRC have seen the fastest growth in recent times. However, there is the growing problem of graduate unemployment. The dramatic increase in tertiary enrollments has not focused on market needs, nor specifically in building the human capacity needed for competitiveness in knowledge-intensive sectors as Singapore ensured.

**Information and Communication Technology:** The PRC needs to make up for lost ground in ICT network readiness and offer competitive prices for services. The promotion of competition in the telecom sector and the spread of the benefits of connectivity to rural and unserved areas will greatly promote inclusive growth. The dominant position achieved by the PRC in e-commerce can further spur competitiveness in high-end services sector occupations with well-orchestrated improvements in telecom infrastructure, universal broadband connectivity, and development of human capital for a digital economy.

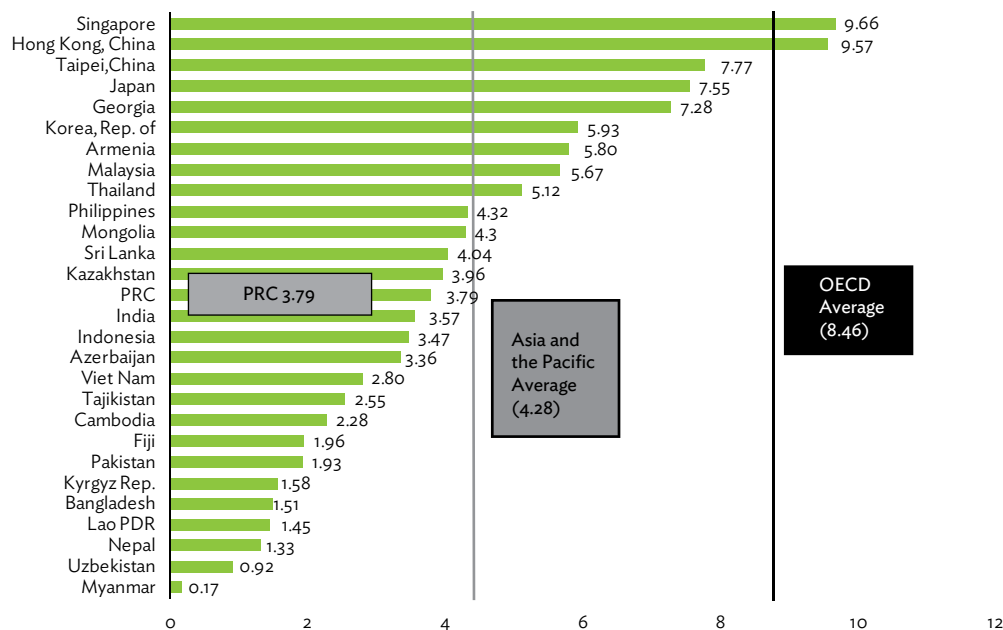
Figure 12 Knowledge Economy Index – PRC



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

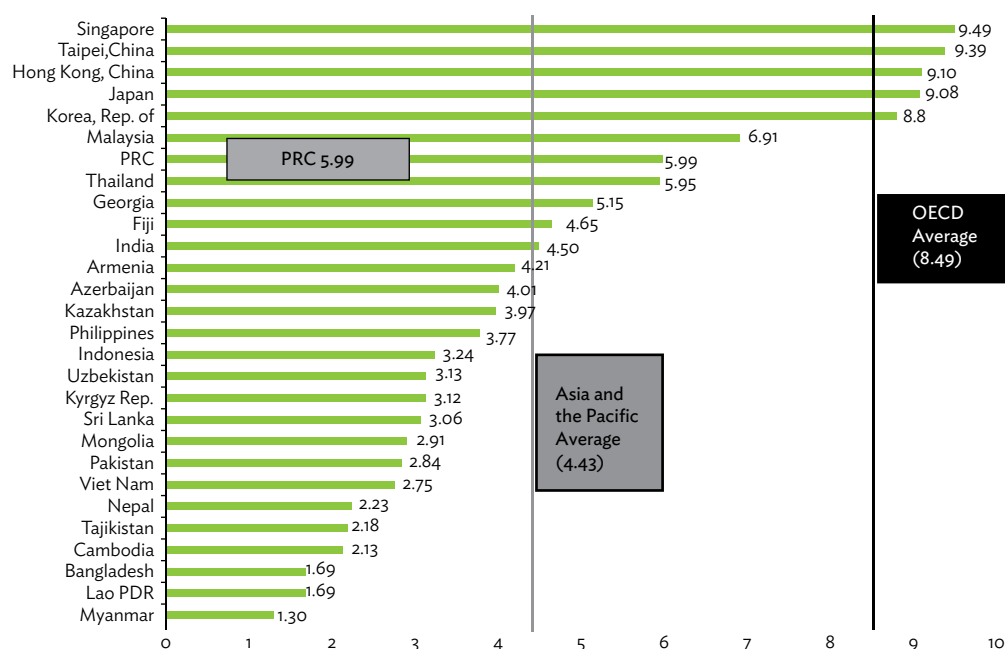
Figure 13 Economic and Institutional Regime Sub-index – PRC



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

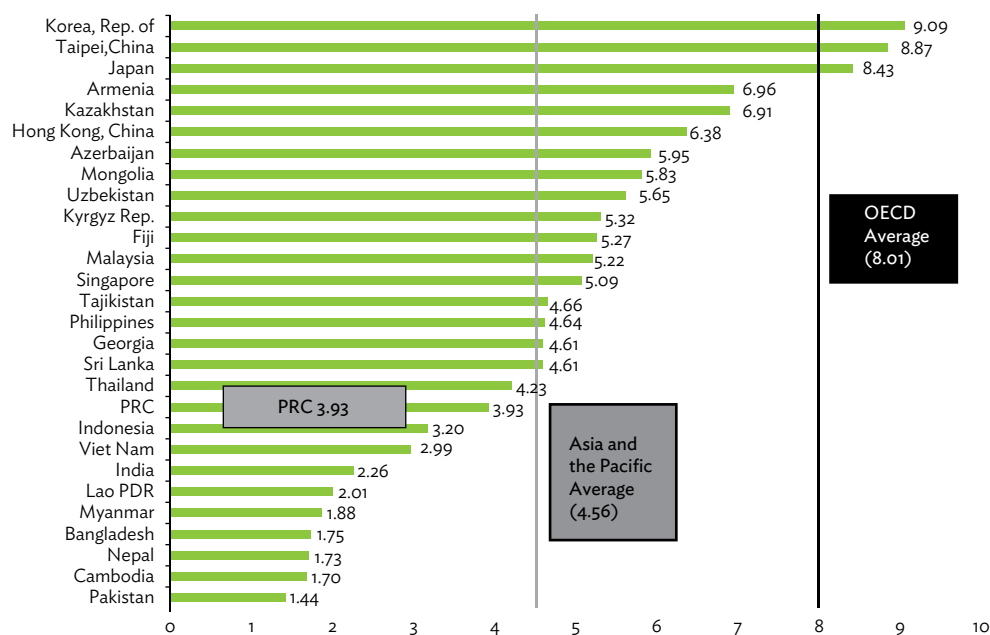
Figure 14 Innovation Sub-index – PRC



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

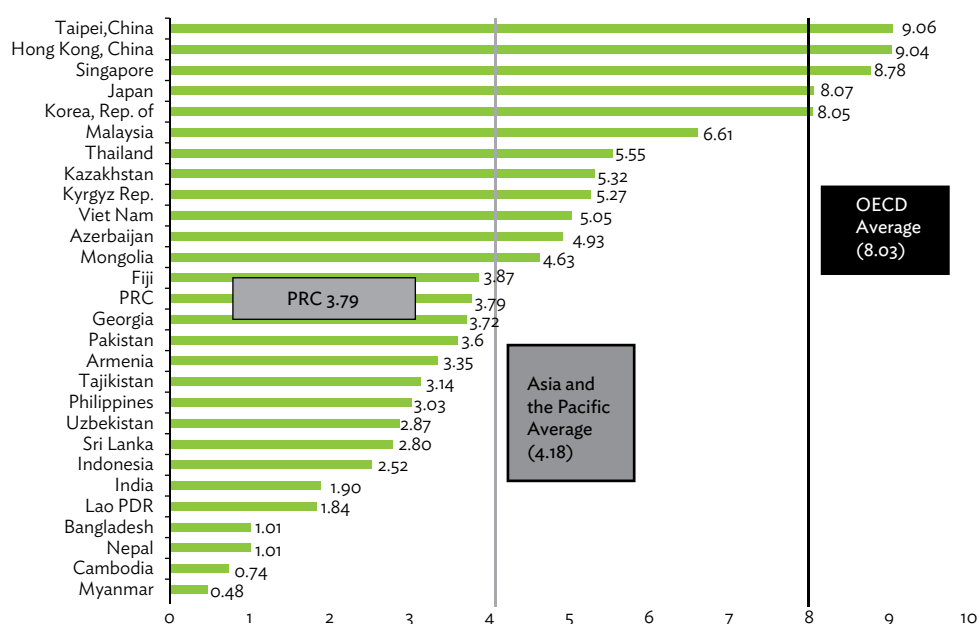
Figure 15 Education and Skill Sub-index – PRC



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

Figure 16 ICT Sub-index – PRC



ICT = information and communication technology, Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

## Indonesia

The support to digital enterprises as part of creative industries to tap into the ever-growing global markets for digital entertainment and games will help knowledge-intensive services to grow

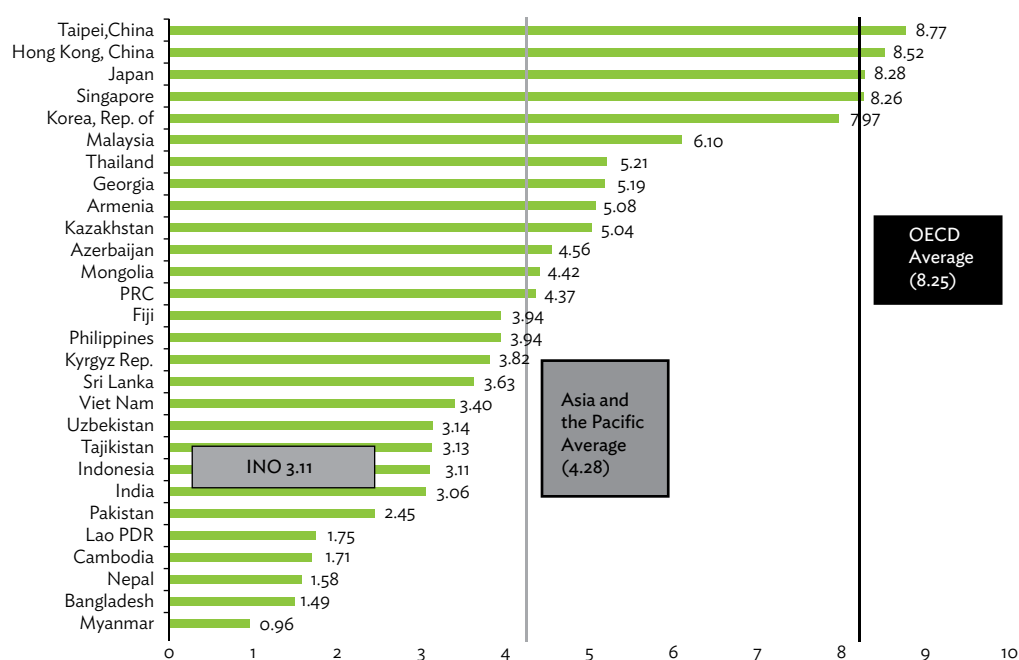
**Economic and Institutional Regime:** The manufacturing sector makes an important contribution to the GDP, yet suffers from low competitiveness compared to other member states of the Association of Southeast Asian Nations (ASEAN). Greater support to expanding the industrial base and improving the productivity and efficiency of natural resource processing industries for intermediate and finished products is required. Support for creating IPR protection for the creative industries will help build global competitiveness and value addition. In anticipation of the ASEAN Economic Community in 2015, there is need to promote well-identified industries for technological upgrading through imported technologies and development of national technological capabilities.

**Innovation:** Support to technological and non-technological innovation in creative industries and in SMEs is needed. Development of the ecosystem for innovation such as brand equity, labeling, and marketing will help the move toward greater participation in global value chains. There is an important need to increase both public and private R&D. Given the large and decentralized country, there is great scope for regional and local innovation systems that draw on the strengths of regional endowments and local talent.

**Education:** Although mean years of schooling have increased, there is need to improve the quality and relevance of post-secondary education, particularly higher-order skills development. The country's public and private tertiary institutions lack in organizational and financial autonomy which limits innovation. Private higher education institutions particularly lag in quality. The roles of higher education and research are crucial to a KBE as are industry–university collaborations. There is need to develop centers of excellence in education to support the economic development corridors of the country's economic master plan.

**Information and Communication Technology:** The country scores quite poorly on the ICT subindex compared to the average for Asia and the Pacific. Still, Indonesia had the fourth largest user base of Facebook in the world in 2013 and is active on social media channels. The rollout of a national broadband plan with universal access and service funds and other means will contribute

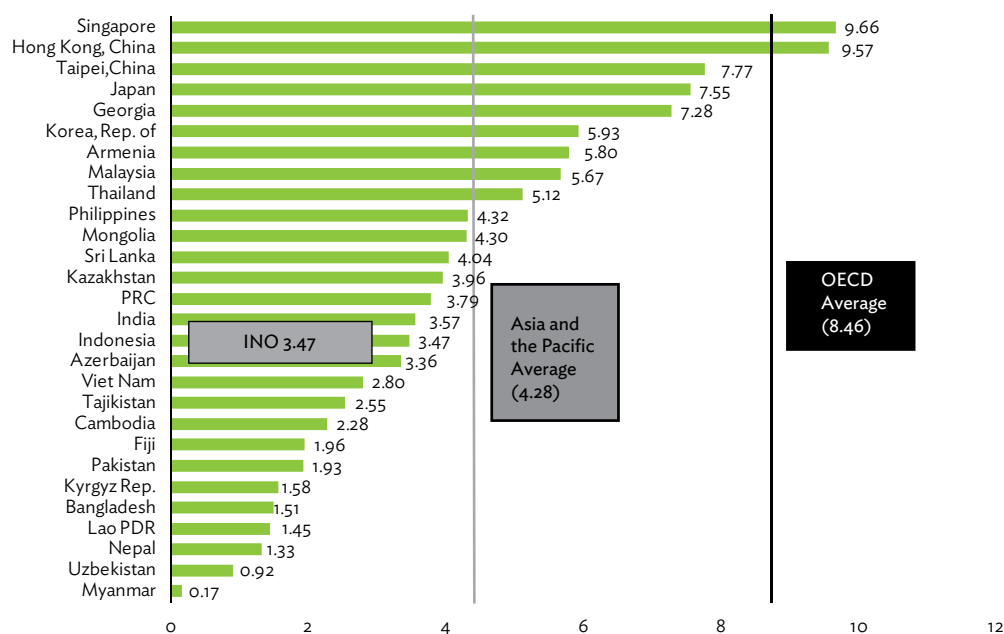
Figure 17 Knowledge Economy Index – Indonesia



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

Figure 18 Economic and Institutional Regime Sub-index – Indonesia

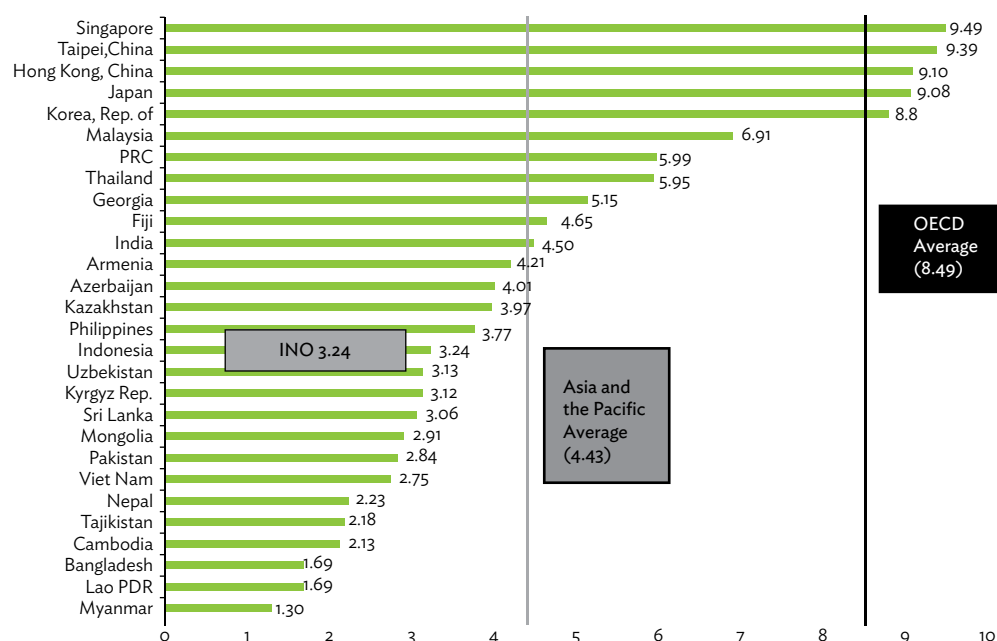


Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.



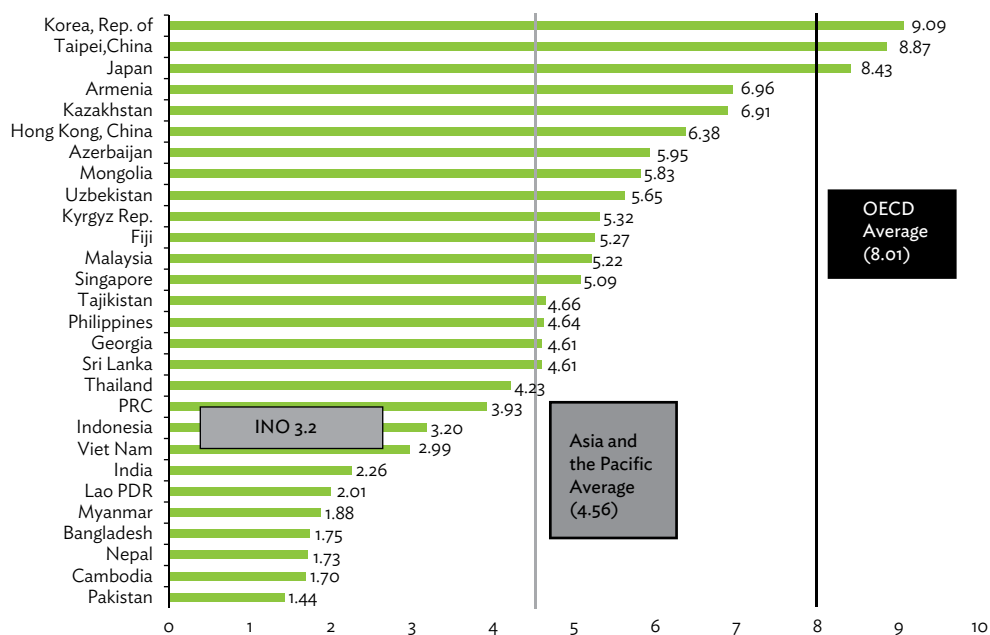
Figure 19 Innovation Sub-index – Indonesia



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

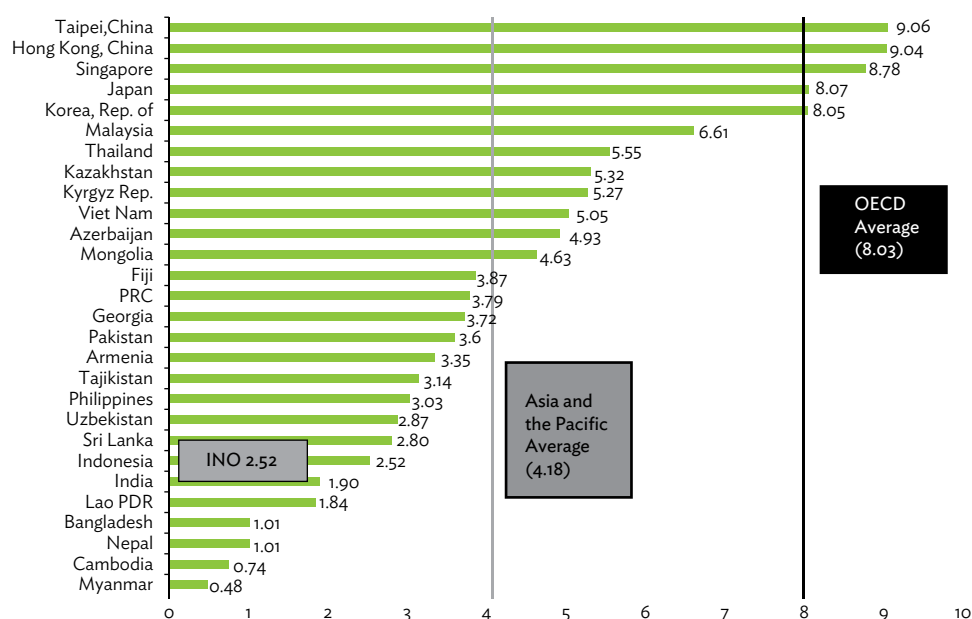
Figure 20 Education and Skill Sub-index – Indonesia



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

Figure 21 ICT Sub-index – Indonesia



ICT = information and communication technology, Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

greatly to inclusive growth. The support to digital enterprises as part of creative industries to tap into the ever-growing global markets for digital entertainment and games will help knowledge-intensive services to grow. The country would also benefit from augmenting social media channels and extensive use of ICT for education.

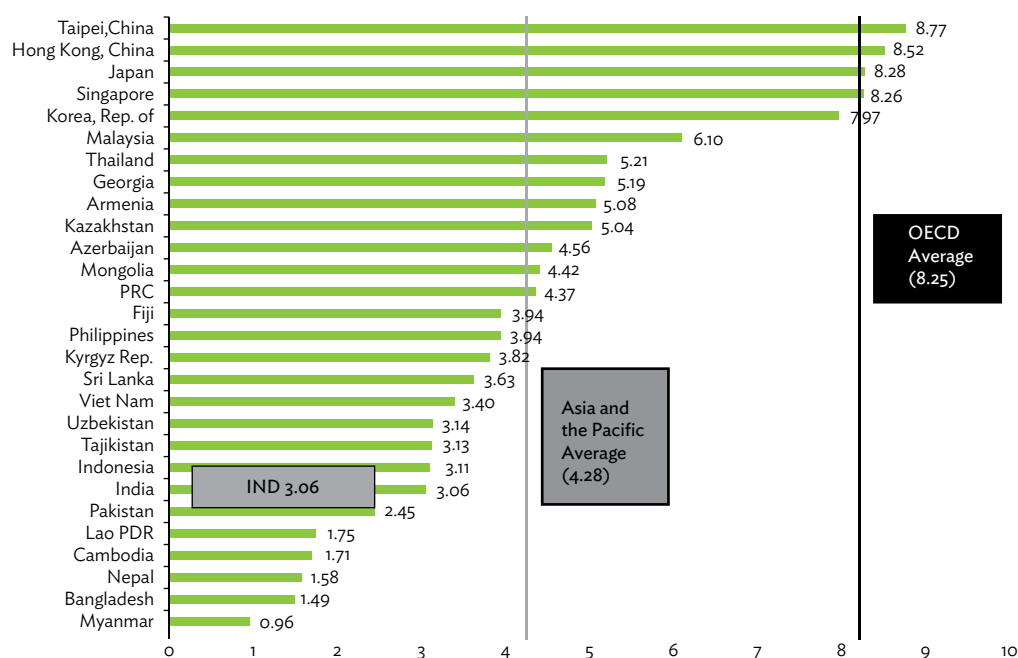
## India

**Economic and Institutional Regime:** There are still considerable barriers to doing business and high tariffs that impede trade. The limited trade diversification in terms of both a narrow export basket and geographic trade partners has constrained progress in international markets. The manufacturing sector has been stagnant, and the time is ripe to incentivize the development of high-end manufacturing.

**Innovation:** There is need to increase R&D investments, both public and private. Strengthening IPR protection, including for the software sector, would stimulate innovation and its commercialization. India has made exemplary progress in “frugal” (or *jugaad*) innovation. Greater allocation of public funding for technologies relevant for bottom-of-the-pyramid customers will be valuable. The recent announcement of the India Inclusive Innovation Fund is a step in the right direction.

**Education:** Tertiary education reforms are not yet extensive and impactful. Although the high priority attached to skills development and expanding tertiary education are commendable, there is a long way to go to improve the quality and relevance of education and redressing the acute skills–jobs mismatches. Reforms to facilitate public–private partnership for tertiary education are yet to be implemented with impact. There is a great need for rationalizing regulations in higher education as well as to redress the lack of linkages between research and teaching in the tertiary sector and promote extensive industry–university alliances. The planned industrial corridors could benefit from the colocation of tertiary institutions for research and commercial incubation of technology.

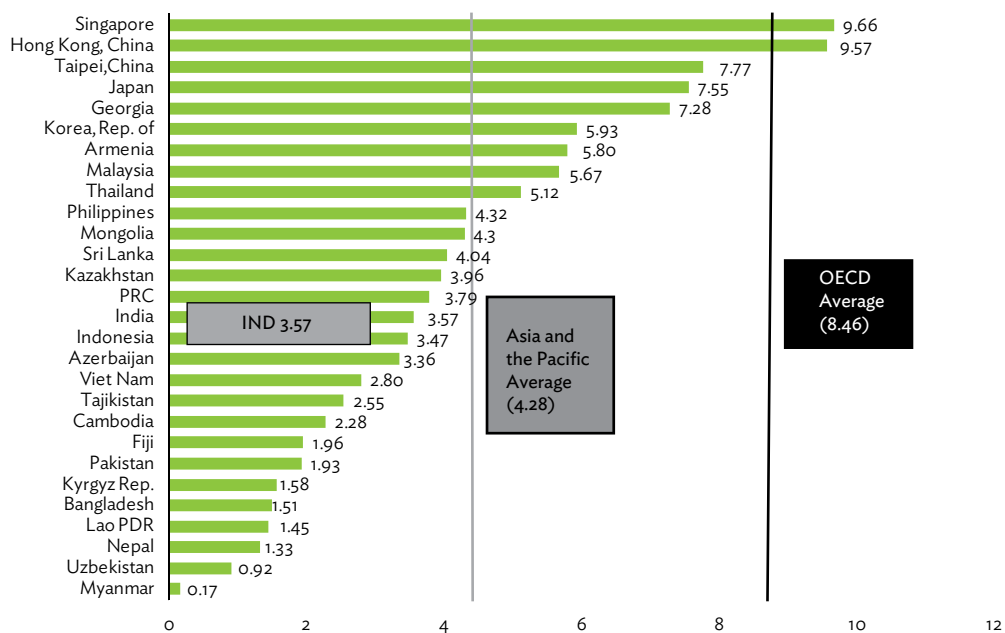
Figure 22 Knowledge Economy Index – India



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

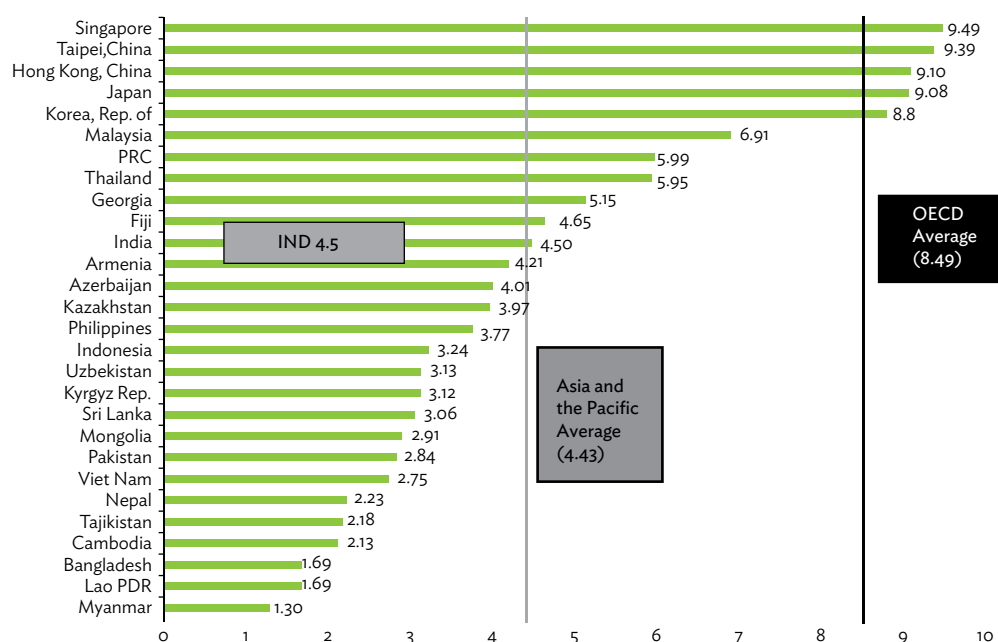
Figure 23 Economic and Institutional Regime Sub-index – India



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

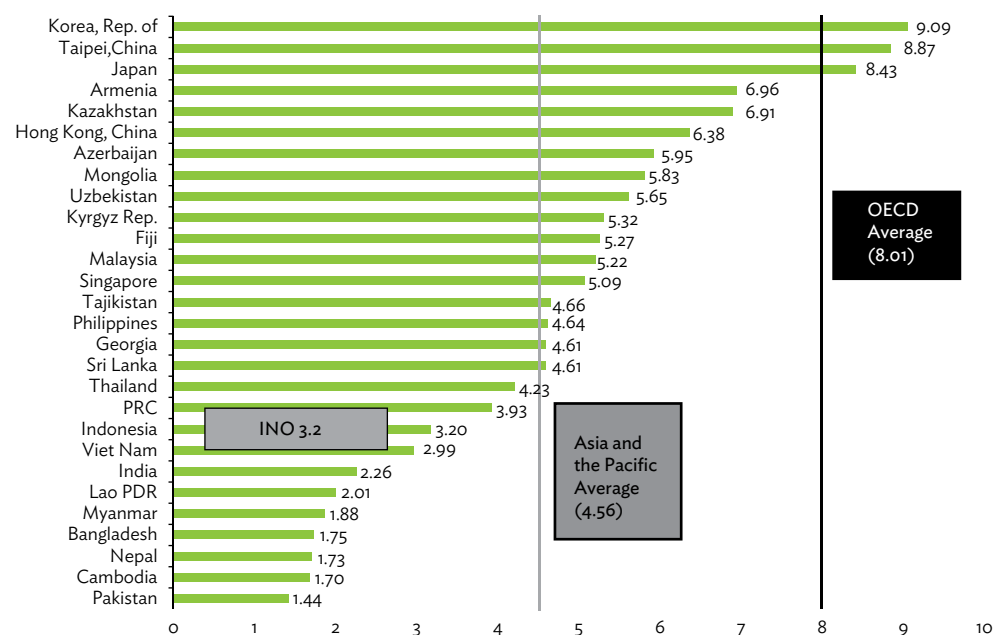
Figure 24 Innovation Sub-index – India



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

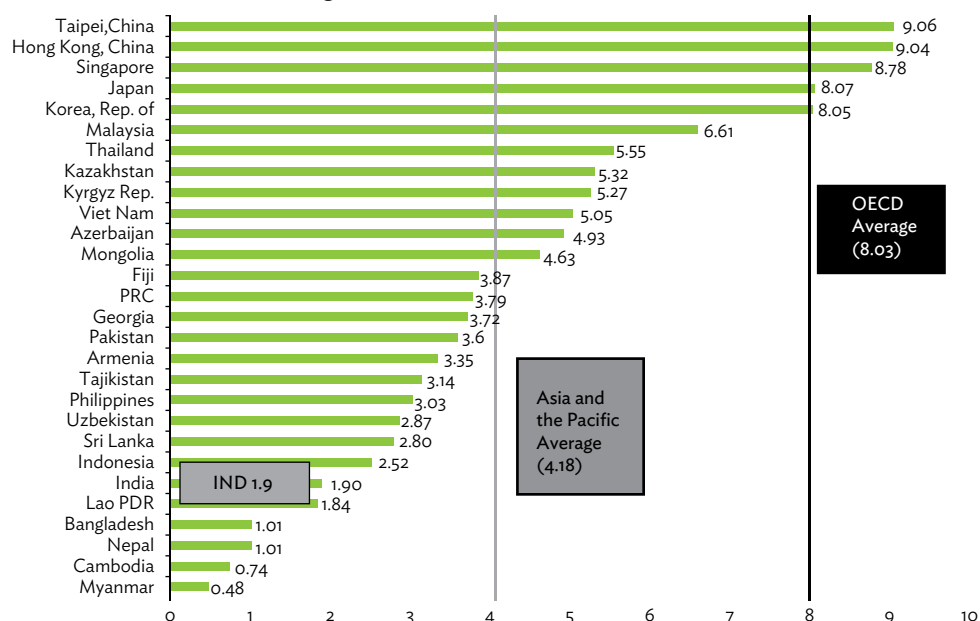
Figure 25 Education and Skill Sub-index – India



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

Figure 26 ICT Sub-index – India



ICT = information and communication technology, Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

**Information and Communication Technology:** ICT infrastructure is still skewed in favor of urban locations. There is need for R&D in the IT sector and greater focus on high-value IT services, with expanding digital literacy and high IT skills. The exemplary price competition for mobile telephony should be extended to high-speed broadband by putting to good use the Universal Service Obligation Fund. There is need to capitalize on mobile penetration with extensive “apps” for development.

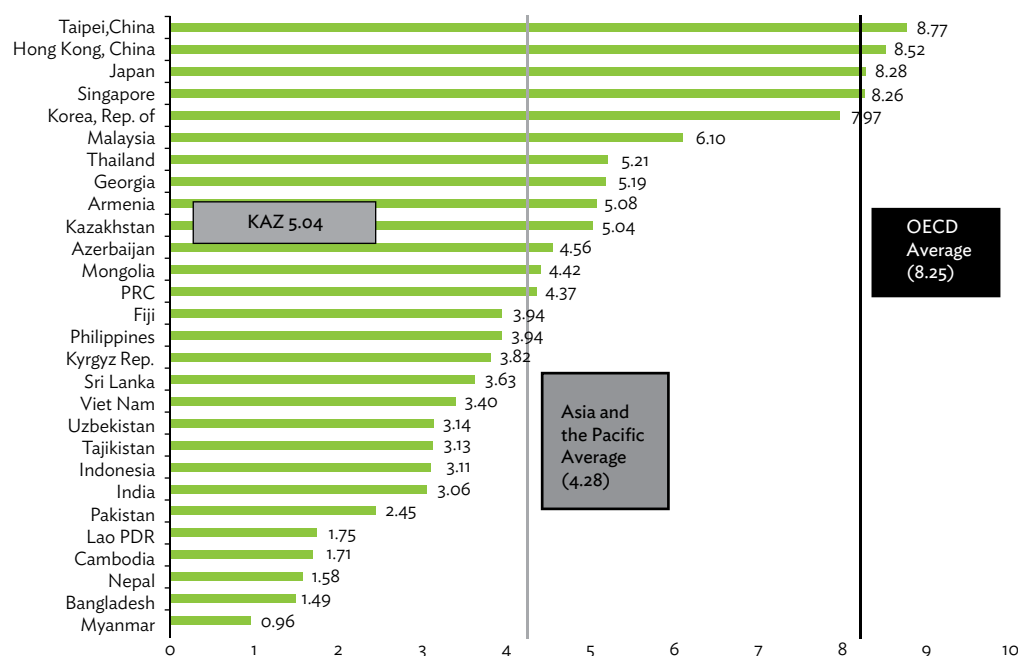
## Kazakhstan

**Economic and Institutional Regime:** Although the country has achieved good progress on Ease of Doing Business indicators, it performs poorly on corruption perception. Active support to new business formation is required, particularly for industrial diversification. Streamlining tariffs in the context of WTO accession and proactive policies to encourage FDI-linked partnerships for industrial and trade diversification will support the objective of reducing the preponderant dependence on natural resource-intensive growth. At the same time, assimilation of technology, particularly through locally generated technological capability, will help to enhance the value addition from oil and gas industries and make them more knowledge-intensive.

**Innovation:** There is need to increase R&D expenditure as a percentage of GDP as well as the number of R&D personnel. Although venture capital funds have been launched, investments in innovation intermediaries are needed: proof-of-concept labs, design houses, standards certification, and technology and market intelligence services.

**Education:** The country enjoys higher mean years of schooling, but the education is of poor quality. Education systems are not supportive of the growth objectives of the country. While a state-of-the-art university, Nazarbayev University, has been set up, national capacity is largely missing in this institution, which is mainly run with international expertise. There is a severe lack of relevant and

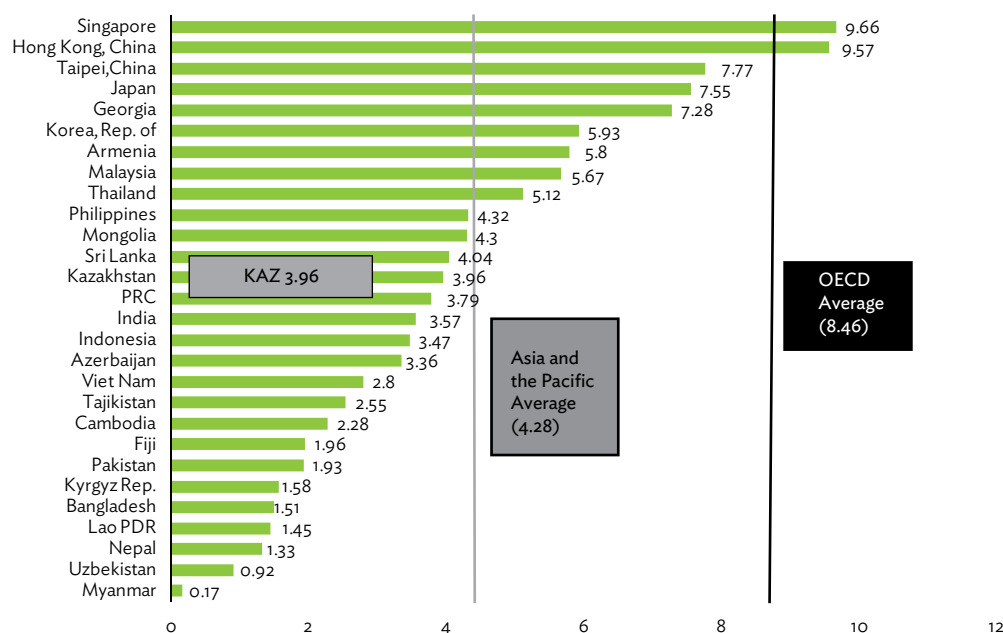
Figure 27 Knowledge Economy Index – Kazakhstan



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

Figure 28 Economic and Institutional Regime Sub-index – Kazakhstan

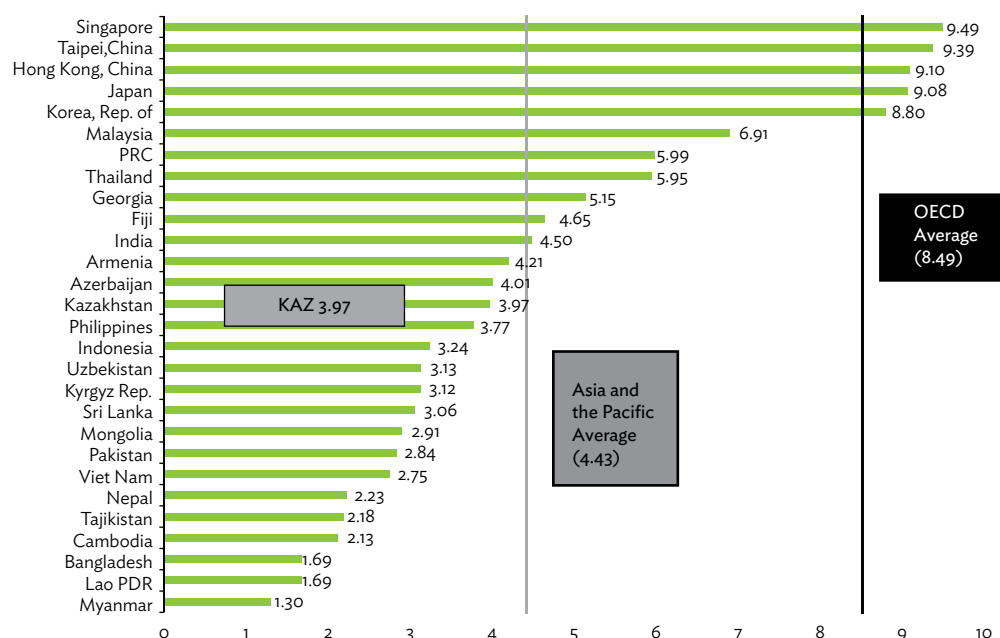


Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.



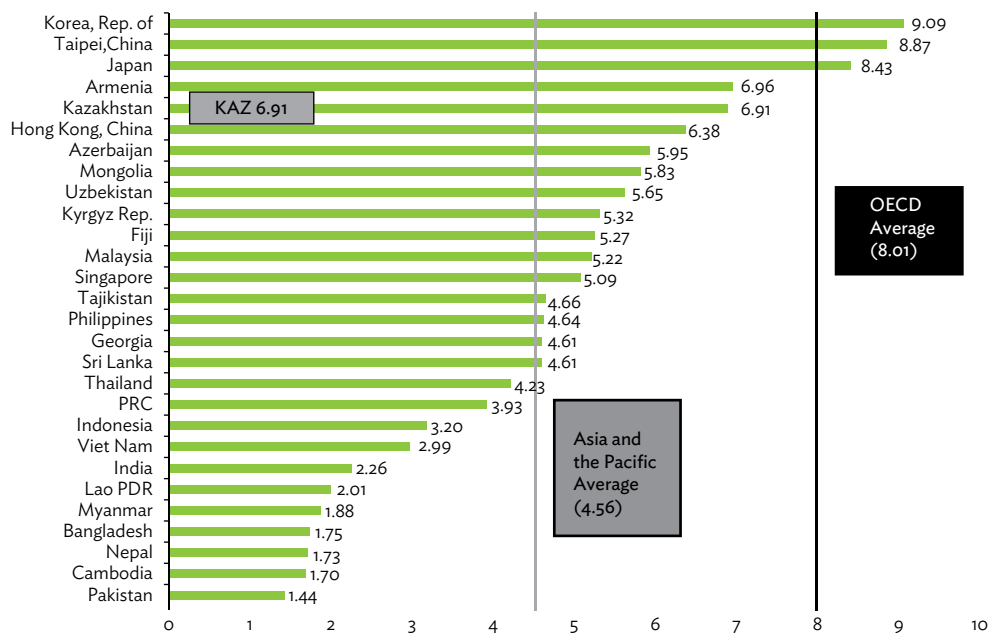
Figure 29 Innovation Sub-index – Kazakhstan



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

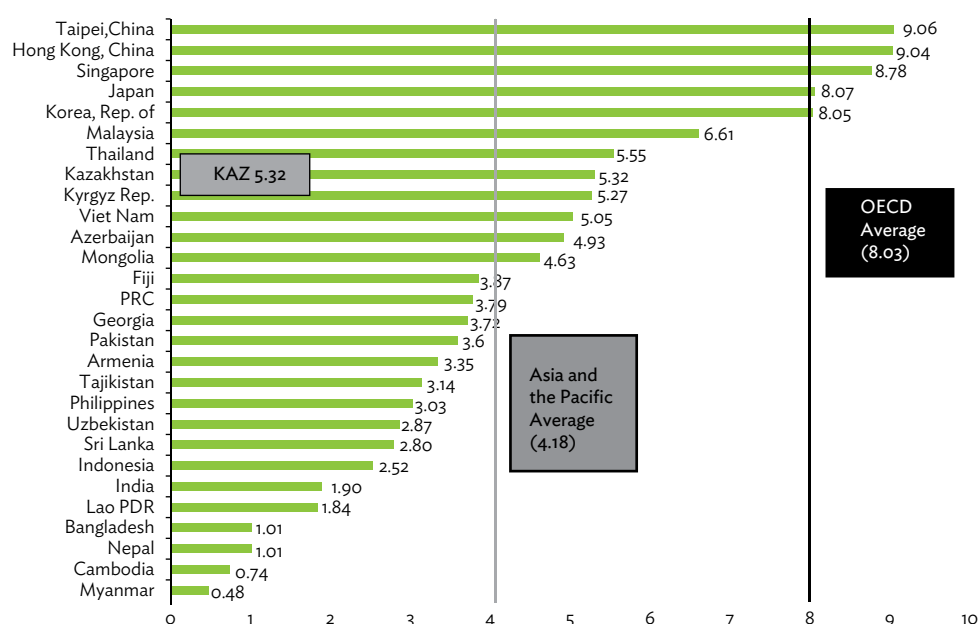
Figure 30 Education and Skill Sub-index – Kazakhstan



Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

Figure 31 ICT Sub-index – Kazakhstan



ICT = information and communication technology, Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

Source: World Bank, Knowledge Economy Index, <http://go.worldbank.org/JGAO5XE940>.

high-quality technical and vocational education and training and higher-order skills for industrial diversification. Technical education is still cast in the old Soviet style education mode and needs to be modernized and made flexible. Tertiary education needs to have links with innovation parks and innovation support instruments that have been put in place by the government, such as technology and entrepreneurship development.

**Information and Communication Technology:** Although Kazakhstan has achieved a good position in network readiness, business usage of ICT is low, particularly for SMEs. There is a great digital divide between rural and urban populations as well as need for liberalization of the telecom sector and increased competition to enable higher penetration. Agglomeration strategies proposed by the government to provide clustered ICT services to the rural population in selected hubs is a good initiative for the short term. Universal broadband access would be needed in the long run.

## 5

# A Possible Road Map for the Knowledge-Based Economy in Developing Asia and the Pacific

This study argues that there are three ways in which emerging economies of Asia and the Pacific can pursue knowledge-based economic development in the current times: the first is learning from the KBE journey of advanced economies and making appropriate investments and policy reforms; the second is exploiting the unique strengths and endowments of the region by pursuing strategies that amplify such strengths; and the third is leveraging game-changing trends in technology and business processes that can enable emerging economies to leapfrog technology development cycles and catch up with the latest. The following table attempts to outline these across the four pillars of the KBE:

Table 2: Possible KBE Roadmap for Developing Asia and the Pacific

LEARNING	EXPLOITING	LEVERAGING
From Advanced Economies	Unique Strengths and Endowments	New Trends for Leapfrogging
Innovation		
<p>Increase investment in R&amp;D as all advanced economies invested significantly in R&amp;D</p> <p>1.5% of GDP allocation to R&amp;D is the order middle-income economies should consider in their journey toward high-income levels</p>	<p>Innovation to increase competitiveness in knowledge-intensive services sector (7 of the top 10 economies in the Global Services Location Index are in Asia).</p> <p>Moving to higher value-added services will be beneficial</p>	<p>Growing prominence of innovation hubs in emerging economies is giving rise to a new class of competitive products which are designed, engineered, and priced for the low- to mid-range market segments. Emerging markets need to step up investments in technologies relevant to such products and focus on gaining IPR for such inventions and frugal products</p>

<b>LEARNING</b>	<b>EXPLOITING</b>	<b>LEVERAGING</b>
<b>From Advanced Economies</b>	<b>Unique Strengths and Endowments</b>	<b>New Trends for Leapfrogging</b>
<p>Middle-income economies need to expand domestic R&amp;D capabilities and technological development to move to the next level</p> <p>Low-income economies can pursue imported technologies and adaptation of R&amp;D initially to build the base for domestic capabilities</p>	<p>Measures to incentivize investment in building knowledge capital—such as brand equity, trademark, and marketing—for niche sectors of competitiveness, particularly sectors such as creative goods, will increase the embodied value addition</p>	<p>Green innovation to increase energy and food security; build on the expansion of decentralized renewable energy solutions, particularly solar energy and innovations for agriculture</p>
<p>Expand quantity and quality of innovation infrastructure—science and technology parks, innovation hubs, R&amp;D labs, incubators for commercialization of technology, and so on</p>	<p>Support start-up entrepreneurial firms for digital enterprises, e-commerce, and IT-enabled services sector</p>	<p>Innovation super clusters in new economy industries such as biotech, nanotechnology, advanced genomics, and advanced materials</p>
<p>Expand financing for innovation—develop capital markets, including venture capital markets, angel investing networks, and innovation intermediaries</p>	<p>Support product development for different domestic market segments; active support to social impact investments</p>	<p>Public funding for R&amp;D to develop technologies relevant to low-income consumers and their commercialization using local networks; support the development of social enterprises</p>
<b>Education</b>		
<p>Increase tertiary education enrollments and access to technical and vocational education and training and skills development; match human resource development with the economic and industrial competitiveness objectives of the economy</p>	<p>Revitalize established and large university campuses with greater financial and administrative autonomy to serve the needs of a knowledge economy; strengthen critical thinking and soft skills</p>	<p>Introduce blended models of education delivery, particularly learning from the advent of the massive open online courses that challenge the brick-and-mortar-only models</p>
<p>Promote a diversified education system; enhance the prestige of technical and vocational education and training and its market value through cooperation between training institutions and employers; develop a spectrum of qualifications and applied degrees that straddle technical, professional, and academic qualifications</p>	<p>Measures to incentivize industry giants to set up leading research labs in universities and develop joint research programs; establish industry–university collaborations in identified industry and economic corridors so that R&amp;D can be commercialized faster and talent development is linked to economic priorities</p>	<p>Expand the use of ICT to completely transform the pedagogy of education and training to make it more student-centered and supportive of creativity; develop just-in-time and “on demand” training and anytime-anywhere learning to improve responsiveness to changing market needs</p>
<p>Enhance support for the establishment of technology incubation centers and technology accelerators; strengthen entrepreneurship education in tertiary institutions and training institutions</p>	<p>Attract diaspora participation for talent to support high-tech start-ups; develop higher education clusters to serve the needs of specific industries</p>	<p>Create and/or strengthen network of decentralized education and training institutions to become a breeding ground for barefoot innovators with favorable patenting incentives</p>

<b>LEARNING</b>	<b>EXPLOITING</b>	<b>LEVERAGING</b>
<b>From Advanced Economies</b>	<b>Unique Strengths and Endowments</b>	<b>New Trends for Leapfrogging</b>
Develop “world class” universities in partnership with leading universities in the rest of the world; develop centers of excellence in major disciplines for science and technology and frontier areas of interest to the economy	Support decentralized R&D that is linked to key development challenges; strengthen applied R&D and partnerships with local businesses	Reengineer education for “digital natives” by assimilating latest ICT and other technologies for pedagogy and delivery, such as game-based and simulation-based teaching and learning, as well as mobile-based learning and upskilling
<b>ICT</b>		
Improve network readiness and invest in backbone ICT infrastructure that has universal access and coverage	Implement national digital literacy plans; ramp up digital skills in the workforce; promote public–private partnerships to ensure higher-order IT skills	Invest in next-generation mobile broadband infrastructure using universal access and service funds to ensure high-speed broadband connectivity
Promote market competition and liberalization in the telecom sector to ensure widespread benefits of the telecom revolution, particularly mobile telephony	Draw on the spectacular growth of mobiles by supporting the creation of appropriate “apps” for social and economic empowerment of citizens	Enable availability of cheap smartphones for m-health, m-education, and m-money; support entrepreneurship and inclusive business opportunities using mobile applications
Bridge the digital divide with universal access and service funds; adopt a national broadband policy; public investment in ICT infrastructure ahead of market demand	Develop and expand provision of training for e-commerce, digital, creative, and entertainment enterprises; support entrepreneurship and business development for these enterprises for both local and domestic markets as well as international markets	Invest in cloud computing and on-demand IT services in anticipation of expectations of the bulk of IT spending moving to cloud computing by 2016
Augment use of ICT to strengthen e-governance and service delivery	Draw on Asia’s leading role in the production and use of ICT goods and services to expand the ICT industry for knowledge-intensive jobs in Asia; expand exports of ICT and IT-enabled services from Asia	Develop high-tech ICT innovation and commercialization hubs encompassing a suite of different market applications to enable Asia to emerge as a world leader in high-end ICT goods and services
<b>Economic and Institutional Regime</b>		
Government to take a leading role of coordination across various agencies to promote KBE; government financing of various KBE infrastructure and initiatives is crucial to open the way for private sector funding	Government support to accelerate commercialization of innovation in key sectors with high social impact, e.g., off-grid solar and wind power technologies that can contribute to energy for all	Promote investment to build knowledge capital for creative industries such as trademarks, brand equity, and market scoping services for small and medium-sized entrepreneurs in niche product segments
Promote high tech start-ups with a range of incentives and support mechanisms; develop policy frameworks to attract private investments in knowledge-based enterprises	Provide financing for R&D of small and medium-sized enterprises; support entrepreneurs to develop products and services with innovative pricing to serve lower-income markets profitably	Enable rapid diffusion of R&D in public goods, e.g., health care to enable availability of drugs at reasonable prices by encouraging competition through appropriate policies such as non-exclusive licenses, wider use of patents, and regulation of monopolistic prices

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<b>From Advanced Economies</b>	<b>Unique Strengths and Endowments</b>	<b>New Trends for Leapfrogging</b>
Strengthen intellectual property rights regimes	Provide incentives to increase choice of technologies that have higher employment intensity, other things being equal	Promote spread of broadband connectivity through affordable and reliable models to consumers in rural areas through shared services platforms or community centers
Develop capital markets (including venture capital) and angel investing networks	Finance “bundled” infrastructure development that combines physical and ICT infrastructure with inclusive finance and banking infrastructure through public–private partnerships	Enable social impact investing; decentralized and smaller Silicon Valley–type environments for diffusion of innovation capabilities

ICT = information and communication technology, IT = information technology, KBE = knowledge-based economy, R&D = research and development.

## **Innovative Asia**

### *Advancing the Knowledge-Based Economy*

This paper provides highlights from an Asian Development Bank (ADB) study titled “Asia’s Knowledge Economies: Next Policy Agenda”. The study outlines policy actions required in developing member countries of ADB to advance as knowledge based economies. It identifies how emerging economies can draw on game-changing technology trends and other developments to move faster toward the global knowledge frontier.

## **About the Asian Development Bank**

ADB’s vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region’s many successes, it remains home to approximately two-thirds of the world’s poor: 1.6 billion people who live on less than \$2 a day, with 733 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.



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